Final Report — Volume V

DeForest Nature Center and Sixth Street Sites Wetland Feasibility Study: Summary Report

Prepared for

City of Long Beach Department of Parks, Recreation and Marine

CH2MHILL
3 Hutton Centre Drive
Suite 200
Santa Ana, CA 92707

May, 2002

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Project Acronyms

afy	acre-feet per year
ASTM	American Society for Testing and Materials
BBA	Breeding Bird Atlas
bgs	below ground surface
BOD	biochemical oxygen demand
C	Celsius
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
cfs	cubic feet per second
City	City of Long Beach
cm/d	centimeters per day
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Coastal Conservancy	California State Coastal Conservancy
CTR	California Toxics Rule
CWA	Clean Water Act of 1972 and its amendments of 1987
dbh	diameter breast height
DeForest Site	DeForest Nature Center Site
DGSG	Dominguez Gap Spreading Grounds
DHS	California Department of Health Services
DOI	U.S. Department of the Interior
EDR	Electronic Database Report
EIR	Environmental Impact Report
ESA	Endangered Species Act
gpm	gallons per minute

GPS	Global Positioning System
HGM	hydrogeomorphic
I-105	Interstate 105
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LARIO	Los Angeles River Bicycle Trail
LARMP	Los Angeles River Master Plan
LBUSD	Long Beach Unified School District
LUST	Leaking Underground Storage Tank
MEP	maximum extent practicable
m/yr	meters per year
mg/L	milligrams per liter
mg/mth or MG/mth	million gallons per month (British Units)
ml	milliliters
MLLW	mean low lower water
MS4	municipal separate storm sewer system
msl	mean sea level
MSPS	Market Street Pump Station
MTBE	methyl tert-butyl ether
NGVD-29	National Geodetic Vertical Datum, 1929 Datum
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity units
NWI	National Wetland Inventory
ppt	parts per thousand
PRC	Public Resource Code
RCB	Reinforced Concrete Box
REC	recognized environmental condition
River Channel	Los Angeles River Channel
RWQCB	Regional Water Quality Control Board

SD	Storm Drain
SI	Species of Interest
Sixth Street Site	Sixth Bridge Street Site
Study	DeForest Nature Center and Sixth Street Sites Wetland Feasibility Study
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Loads
TSS	total suspended solids
TN	total nitrogen
TP	total phosphorus
TPL	Trust for Public Land
µg/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
VOCs	volatile organic compounds
WQA	Water Quality Act
WRD	Water Replenishment District of Southern California
WSCMO	Weather Service Contract Meteorological Observatory

Project Executive Summary

The DeForest Nature Center and Sixth Street Bridge Wetland Restoration and Water Reuse Feasibility Study (Study) was undertaken by the City of Long Beach (City) and the California State Coastal Conservancy (Coastal Conservancy), in conjunction with CH2M HILL, Lynn Capouya, Inc., and John Caldwell Architects. The purposes of the Study were to: 1) Evaluate the feasibility of conversion and restoration to wetland and riparian habitats of the DeForest Nature Center Site (DeForest Site) and the Sixth Street Bridge Site (Sixth Street Site), both along the present Los Angeles River Channel; 2) Determine what public use elements could be included in the plans to enhance recreational use and enjoyment of the sites, including the siting of an Interpretive Center; and 3) Determine if the quality of the water used at the DeForest Site would be sufficiently improved after passing through the created on site wetlands, so that all or some can be used in on- or off-site irrigation.

In completing the Study, CH2M HILL and Lynn Capouya, Inc., in association with John Caldwell Architects, have produced this Final Report as a summary report of a series of interim reports. The *Task 3 Report: DeForest Nature Center and Sixth Street Sites Wetland Feasibility Study: Data Collection and Opportunity Analysis,* Volumes I and II (*Task 3 Report*) was submitted by CH2M HILL, Lynn Capouya, Inc., and John Caldwell Architects in December, 2001. The *Task 3 Report* provided the baseline information and constraints analysis for development of conceptual alternatives under Task 5 of the Study. The *Task 5 Report: DeForest Nature Center and Sixth Street Sites Wetland Feasibility Study: Conceptual Plans and Alternatives,* Volume III (*Task 5 Report*) was submitted by CH2M HILL and Lynn Capouya, Inc. in March, 2002. This report presented three conceptual restoration and development alternatives for the DeForest and Sixth Street Sites, based on all Technical Advisory Committee (TAC), public, and client input on the project to date. The *Task 7 Report: DeForest Nature Center and Sixth Street Sites Wetland Feasibility Study: Results of Water Treatment Bench-Scale Wetland Test,* Volume IV (*Task 7 Report*) was submitted by CH2M HILL in May, 2002. This report presented the results of the separate bench scale study conducted to determine water quality treatment capacity of wetland designs at Deforest Site.

This Final Report summarizes the Study findings and alternatives, as provided in the *Task 3 Report,* the *Task 5 Report*, and the *Task 7 Report*. The executive Study summary is provided here by task report.

Task 3 Report

The *Task 3 Report* presents regional and site-specific data on biological, recreational, and physical characteristics and associated opportunities and constraints for wetland and riparian restoration and recreational/public use improvements. The report compiles available information and newly collected data on baseline conditions for each of the sites. Extensive data on existing site topography, water source quantity and quality, public use features, existing soils, historic and current biological resources, site infrastructure, regulatory requirements, and site environmental conditions are presented. The *Task 3 Report* also addresses the constraints to habitat restoration and recreational/public use

improvements posed by each site's physical features, existing utilities and infrastructure, and potential water supply sources. The broad scope of opportunities for habitat restoration and recreational and public use amenities at each site are also discussed.

This report was provided to the project's TAC for review of data adequacy and for comment on each site's opportunities and constraints, and the contents were the topic of the second TAC meeting. At this meeting, the TAC members discussed opportunities and constraints and direction was provided on the types of habitat and recreational/public use improvements to develop into concepts for the next phase of the project.

The data collected and analyzed for each site indicate that each would require some grading and additional water to create the optimum site hydrology and maximum wetland habitat. Use of only onsite nuisance flows and stormwater runoff would allow creation of riparian habitat with limited emergent marsh. Use of supplemental water would be needed to create more extensive marsh and open water habitats. The potential supplemental sources of water identified include the Los Angeles River, reclaimed City water, additional City stormwater diversions and, for the DeForest Site, Interstate 105 groundwater. Existing utilities and infrastructure do pose some constraint to site improvements; however, site environmental conditions do not pose a significant constraint to site development as indicated by relevant contaminant database searches.

The opportunities for habitat restoration and recreational/public use improvements at the sites include development of river riparian scrub, freshwater emergent wetland, back dune scrub, and salt/brackish marsh habitats and passive use facilities such a interpretive displays, observation platforms and self-guided trails. Creation of up to 35 acres of wetland and riparian habitat is possible at the DeForest Site and up to 1 to 3 acres of salt or fresh marsh habitat at the Sixth Street Site.

Linking of the DeForest Site with the Dominguez Gap East Basin is feasible and would help to maintain adequate flood storage capacity while expanding wetland habitat creation at the DeForest Site. This could be accomplished by allowing drainage of peak storm flows or wetland flows south of the Market Street Pump Station to discharge through a culvert to the Dominguez Gap East Basin. This water could be used at the Dominguez Gap Basins for habitat restoration or discharged to the Los Angeles River via the Dominguez Pump Station. Linkage could also facilitate use of Interstate 105 water for habitat restoration at the DeForest Site and habitat restoration and/or groundwater recharge at the Dominguez Gap East Basin.

Task 5 Report

At the second TAC meeting, and in subsequent discussions with the City and the Coastal Conservancy, three conceptual alternatives were developed for wetland restoration on each site. CH2M HILL and Lynn Capouya, Inc. have developed plans for these conceptual alternatives, which are presented in the *Task 5 Report*. The conceptual alternatives were finalized as the following. For the DeForest Site: (1) enhancing the existing woodland and open areas by removing exotic vegetation and replanting with native species; wetland habitat would be limited to that supported by existing stormwater flows; (2) water treatment alternative for reuse with one potential source of water being Los Angeles River water; water would flow through to the Market Street Pump Station before being

discharged to the Los Angeles River or pumped into the recycled water system; and (3), maximum wetland habitat alternative with water passing completely through the DeForest Basin to Dominguez Gap Spreading Grounds, with one potential source being the California Department of Transportation Interstate 105 water. Recreational development for these alternatives would range from minimal enhancement of existing uses for Alternative 1, to maximum development for passive use in Alternative 3. For Sixth Street Site: (1) at grade revegetation with native scrub and/or tree species for rest stop or pocket park; (2) pump-supplied freshwater wetland using augmented or existing storm water; and (3) excavated and designed for a tidal connection for a salt/brackish marsh. Recreational development would vary by alternative, including appropriate facilities/design for a bicycle rest stop or pocket park, or user access facilities for the wetland designs.

The *Task 5 Report* provides the preliminary conceptual designs for these alternatives. Included in the conceptual design are grading plans, with associated lateral cross-sections. Grading plans were used to develop basin volume for the DeForest Site to evaluate changes to potential flood storage capacity; this information is also presented. Infrastructure necessary for site development is identified, mapped, and described, and preliminary design drawings presented for sample infrastructure components. Habitat planting schemes are provided, including plan views, conceptual cross-sectional renderings, and plant palettes; habitat features or types that would benefit wildlife are also identified and shown on plan views. Recreational plans are developed for each alternative, and these developments are indicated on plan views and cross-sectional renderings. Further analysis of recreational and habitat compatibility is presented in the *Task 5 Report* text, and summarized in this report. For wetland alternative development, water budgets are estimated, and for treatment alternatives potential treatment capacity of the treatment wetland is analyzed. Cost estimates of construction and maintenance have been developed, and are also presented. Finally, a summary review of the alternatives is presented.

Task 7 Report

A bench-scale treatment wetland study was conducted for the DeForest Site in Long Beach, California, to evaluate varied treatment approaches for improving water quality for habitat enhancement, and to evaluate the potential to treat water to California Title 22 water quality standards. The water quality performance data will establish criteria for the final design of the wetlands and filter media.

The bench-scale study was conceived, reviewed, and accepted by all interested stakeholders. CH2M HILL staff developed final construction schematics for the bench-scale system and, through correspondence with City and stakeholder representatives, finalized system design. Operation, maintenance, and monitoring (frequency and type of performance evaluation) of filtration systems were addressed in the evaluation of design options. The filter medium characteristics (medium depth and effective size) were selected on the basis of influent quality (total suspended solids and particle size distribution) and desired effluent quality as specified in Title 22 standards.

CH2M HILL and the City staff constructed and operated the bench-scale system for a period of 10 weeks with two 5-week bench-scale tests conducted. Weekly monitoring was conducted to evaluate water quality improvements for the two source waters — the storm

drain system feeding DeForest Park and the Los Angeles River. Water samples associated with the bench-scale water quality system were collected and analyzed.

A sand-only filter and a sand-iron filter (each a 50-gallon barrel) were tested. The sand-only filter, packed with two grades of silica sand and gravel, reduced total coliform counts by week 10 to below Title 22/Secondary 23 Recycled Water Criteria levels at the 7-day median most probable number (MPN) minimum of 23 MPNs per 100 milliliters (ml). In contrast, the sand-iron filter, packed with two grades of silica sand and a 4-inch layer of iron filings, reduced total coliform counts by week 10 to 70 MPNs per 100 ml.

Each sand filter efficiently removed all nutrients as expected. Ammonia, nitrate, total Kjeldahl nitrogen (TKN), and total phosphorus were either below the detection limit or declined rapidly. Specifically, nitrate and total phosphorus produced the best reductions with the sand-iron filter; the sand-only filter provided the best ammonia removal.

Final Report

This final report provides a summary of the most relevant information in the other task reports, and provides a final Recommendations section, which summarizes the additional information requirements for full project implementation, reviews TAC or Public input on site proposals, and identifies the next steps forward toward full project implementation.

Key recommendations include verifying key elevations on the DeForest Site for wetland cell design, and for the Sixth Street Site Alternative 3 verifying mean tidal elevations, since habitat designs in salt/brackish marshes are relative to tidal elevations. The potential impact of surface water/soil saturation on infrastructure supports should be evaluated. For the DeForest Site, final design of storm drain outfalls and trash removal mechanisms are contingent on decisions about the best approach for this. Information being evaluated outside the scope of this Study, and decisions based on this, will determine which water source alternatives at DeForest Site are ultimately feasible; this includes review of water rights on the Los Angeles River and decisions on the ultimate fate of Interstate 105 groundwater; these factors should be tracked, since their outcome is critical to project outcomes at DeForest. Potential for groundwater contamination should be evaluated at both sites, given the proximity of nearby contamination concerns. Final habitat designs should be developed once alternatives are selected and other factors resolved; for Sixth Street Site, a salinity study of the adjacent Los Angeles River will be required prior to habitat design for Alternative 3.

To realize the vision of habitat restoration and public use enhancement at the Deforest and 6th Street sites a series of additional steps must be undertaken. These include: a Master Plan process to refine alternatives, selecting the preferred alternative, completing the necessary regulatory/environmental compliance steps, completing the final design and bid documents, awarding a construction contract and implementing long-term operation and maintenance activities.

1.0 Introduction

1.1 Introduction

1.1.1 Background

Early explorers to the Los Angeles River region described a lush, well-watered landscape of dense willow and alder thickets, bottomland forests, and vast marshlands filled from river overflow. Flows in the Los Angeles River would range from raging torrents in the rainy season to a slow, shallow stream in the summer months. A large network of tributaries, side channels, and sloughs were present, some also with perennial flow, but some dry except for seasonal flows or intermittent flood flows. The extensive floodplain and river meanders supported large populations of waterfowl and other birds; steelhead spawned in the river, and grizzly bear foraged on the shores. As the river neared its mouth in the Pacific Ocean south of the Palos Verdes Peninsula, in what is presently the City of Long Beach, a wide-open delta supported extensive salt and brackish marshes, with numerous backwaters and sloughs. Coastal estuarine areas also supported large bird populations, and fish would spawn in the estuaries and utilize them in early life stages.

As the population grew in the Los Angeles Basin in the 1800s and early 1900s, the Los Angeles River provided the main source of water for domestic and agricultural use and, in time, the entire surface flow of the river was diverted and dried up; subsurface flows were also dried up in time. The extensive marsh and riparian habitat in the river plain began to disappear. Increasing settlement occurred on the river's floodplain and, in time, the substantial winter floods became a menace. Catastrophic floods occurred in 1914, 1934, and 1938; these led to the creation of a comprehensive regional flood control program that included flood reservoirs to hold back floodwaters, channelization of the lower river, and lining the channels with concrete to provide maximum conveyance capacity during flood events. This flood control infrastructure dramatically altered the landscape, and created the concrete channel that we know today as the Los Angeles River.

In more recent years, there has been and increased interest in restoring some of what was lost when the original river was channelized, as well as providing natural habitats in the intensely urban environment in the Los Angeles Basin. This effort has been championed by groups such as the Los Angeles and San Gabriel Rivers Watershed Council, Friends of the Los Angeles River, the Natural History Museum of Los Angeles County, the California State Coastal Conservancy, and others who have been promoting alternative approaches to watershed management on the Los Angeles River, including restoring native habitats in the few remaining locations along the river that have not been substantially developed. These groups have recognized the significant opportunities afforded by the extensive tracts of land along the river in the City of Long Beach, which have been undeveloped or previously underutilized. This includes the DeForest Park Expansion Site, the Dominguez Gap Spreading Grounds, and a series of parcels to the south of Dominguez Gap collectively referred to as Wrigley Heights. These sites, alone or in combination, offer a singular

opportunity for habitat restoration along a nearly 10 kilometer (6 mile) reach of the river. The Sixth Street Site, located closer to the mouth of the Los Angeles River, has also been recognized, in part, for its potential to provide a rare pocket of brackish marsh habitat.

The DeForest Nature Center and Sixth Street Wetland Restoration and Water Reuse Feasibility Study (Study) is being undertaken by the City of Long Beach (City) and the California State Coastal Conservancy (Coastal Conservancy), in conjunction with CH2M HILL and Lynn Capouya, Inc., to evaluate two sites along the present Los Angeles River Channel (River Channel) for feasibility for conversion and restoration to wetland and riparian habitat; and secondly, to determine if some or all of the water can be recovered from the wetland sites to be utilized as on- or off-site irrigation. The general location of the two sites is indicated in Figure 1-1. The first of the two sites is the DeForest Nature Center Site (DeForest Site; also referred to as the DeForest Park Expansion Site), located in the City of Long Beach, north of Del Amo Boulevard and South of the developed DeForest Park, just east of the levee along the east bank of the Los Angeles River (Figure 1-2). The second site is the Sixth Bridge Street Site (Sixth Street Site), located just south of the Shoemaker Bridge, in the City of Long Beach (Figure 1-3). The DeForest Site is currently owned by the Los Angeles County Department of Public Works (LACDPW) and leased to the City. The Sixth Street Site is owned by the City. However, a land exchange agreement is pending that transfers title to the State Lands Commission. The State Lands Commission will then lease the property back to the City on a 49-year lease. Both sites are located along the Los Angeles River, which has been proposed as one possible water source for wetland restoration on the sites.

1.1.2 Study Purpose

The objectives of the Study were to:

1. Determine how best to restore wetlands habitat at the two subject sites; wetlands targeted would be wetlands that were historically associated with the lower Los Angeles River and with the coastal portions of other streams in the vicinity, including brackish, riparian, seasonal, and freshwater emergent habitats.

2. Evaluate the potential for water quality treatment through natural treatment wetlands and/or gravel filters on the subject sites, and to evaluate the potential for water reuse for on- or off-site irrigation after flow through the wetlands.

3. Maintain current flood storage capacity on the DeForest Site, and to maintain pump station operations for emptying storm drain storage at both sites.

4. Identify opportunities for public use and enjoyment of native habitat areas, including integration of trails and other access, and to evaluate potential siting locations for a small visitor center and office facilities.

Funding for the Study was provided jointly by the Coastal Conservancy and the City. Coastal Conservancy objectives for the Study emphasize restoration of native habitats and public use consistent with native habitats, congruent with Chapter 6 of Division 21 of the Public Resources Code (PRC; Sections 31251 *et seq.*) regarding enhancement of coastal resources. The City's objectives for the Study emphasize habitat, public use, and water treatment and reuse. The State Lands Commission, future owner of the 6th Street Site,

requires that the City maintain or improve the Public Trust values of the site. These include public access, recreational use, wildlife enhancement and wetland restoration.

1.1.3 Study Process

Both sites are recognized for their potential suitability for wetlands restoration, including proximity to the Los Angeles River, flat or low topography, history of wetlands on site, vacant land of adequate size, other adjacent wetland areas, and supportive public landowners. Additional factors affecting wetland feasibility are not well documented. Some such issues that were evaluated in the Study include:

- Physical, biological, and engineering issues, such as sources and quality of water, and methods for delivering and managing water, water balance equations for the sites, soil types, target habitats and species, infrastructure compatibility, and operation and maintenance requirements.
- Issues affecting integration into the adjacent communities, including identifying community interests and concerns, use of the wetlands for water treatment and reuse, alignment of trails and other passive public uses, and location of a nature education center.
- Regulatory issues that could affect project implementation, including federal, state, and local regulations, including water reuse requirements and water rights issues.
- Funding and administrative issues, such as planning level estimates of construction and management costs, sources of funding, and identification of management entities.

A key component of a successful Study approach is to involve the public and key stakeholders at critical junctures in the Study. For this reason, a Technical Advisory Committee (TAC) of key scientific and agency technical specialists was assembled by the State Coastal Conservancy to advise on the Study, and public meetings were held to solicit public involvement and concern.

Study Tasks

The following major tasks were implemented in completion of the Study:

1. Preliminary Constraint Analysis: Preliminary identification of potential insurmountable obstacles and constraints enables advance planning and resolution for these issues.
2. TAC Meeting No. 1 and Public Meeting No. 1: Early coordination with the TAC and the public includes presenting the objectives of the Study and early input regarding Study objectives, methods, and approach.
3. Compile Available Baseline Information and Identify Opportunities and Constraints: This task involved extensive data collection on existing site topography, water resources, public use, soils, biology, site infrastructure, and site hazards, and evaluation of opportunities and constraints arising from this data collection. This information was compiled into a report for TAC review.

4. TAC Meeting No. 2: This mid-Study meeting enabled presentation of data collection and opportunity/constraint analysis, and solicited TAC involvement in directing subsequent tasks.

5. Develop Conceptual Plans with Alternatives: This key task involved assimilating site information and opportunities/constraints and developing site-suitable conceptual restoration and recreation designs. These designs were compiled into a report for TAC review.

6. TAC Meeting No. 3, Public Meeting No. 2, and Final Report: A final TAC meeting discussed the report findings, and a second public meeting solicited stakeholder input. Based on these meetings, this final report was compiled from previous interim reports. This final report contains a summary of all findings, recommendations, and conceptual designs, as well as a summary of the bench scale study, described below under (7).

7. Develop a bench scale wetland module that could be used to evaluate treatment capabilities of treatment alternatives for the DeForest Site, using water from two sources including the Los Angeles River and LACDPW storm drains in the vicinity of DeForest Park.

Interim Reports

The *Task 3 Report: DeForest Nature Center and Sixth Street Sites Wetland Feasibility Study: Data Collection and Opportunity Analysis,* Volumes I and II (*Task 3 Report*) was submitted by CH2M HILL and Lynn Capouya, Inc. in December, 2001 (CH2M HILL 2001d). This report presented regional and site-specific data on biological, recreational, and physical characteristics and associated opportunities and constraints for wetland and riparian restoration and recreational/public use improvements for the DeForest and Sixth Street Sites. The *Task 3 Report* provided the baseline for development of conceptual alternatives under Task 5 of the Study. The key contents of the Task 3 Report are summarized in Section 2.0 of this report.

The *Task 5 Report: DeForest Nature Center and Sixth Street Sites Wetland Feasibility Study: Conceptual Plans and Alternatives,* Volume III (*Task 5 Report*) was submitted by CH2M HILL and Lynn Capouya, Inc. in March, 2002 (CH2M HILL 2002a). This report presented the conceptual alternatives for DeForest and Sixth Street Sites, as finalized during TAC, public, and client meetings. The key alternative features of the Task 5 Report are summarized in Section 3.0 of this report.

The *Task 7 Report: DeForest Nature Center and Sixth Street Sites Wetland Feasibility Study: Results of Water Treatment Bench-Scale Wetland Test,* Volume IV (*Task 7 Report*) was submitted by CH2M HILL in May, 2002 (CH2M HILL 2002b). This report presented results of the bench-scale treatment wetland study conducted for the DeForest Site, which evaluated varied treatment approaches for improving water quality using treatment wetland technology. The water quality performance data generated from this study will establish criteria for the final design of the wetlands and filter media. A summary of the contents of the Task 7 Report are provided in Section 4.0 of this report.

1.1.4 Stakeholder Input

Technical Advisory Committee

The TAC was assembled from key resource agency personnel, scientific advisors with a demonstrated interest in the Los Angeles River restoration, citizen's interest groups, and County and City representatives. Table 1-1 lists the TAC members and affiliations. An initial site walk and TAC meeting was conducted on August 7, 2001, a second TAC meeting to review site existing conditions and opportunities and constraints and recommend alternatives for consideration was held on December 19,2001 and a third TAC meeting to review project alternatives was held on April 8, 2002.

TABLE 1-1
Technical Advisory Committee Members

Name	Organization
Joseph Giri	West End Community Assoc. of Downtown Long Beach
Rick Borges	North Long Beach Neighborhood Association
Martha Thuente	North Long Beach Redevelopment Area Project
Shirley Birosik	Regional Water Quality Control Board
Helene Ansel	Assemblyman Allan Lowenthal's Office
Kevin Clark	U.S. Fish and Wildlife Service
Frank Sanchez	City of Long Beach Dept. of Public Works
Ron Lockmann	U.S. Army Corps of Engineers
Daniel Cooper	Audubon Society
Kimball L. Garrett	Natural History Museum of Los Angeles County
Brad Henderson	California Dept. of Fish and Game
Joan Greenwood	Friends of the Los Angeles River
Daniel Sharp	Los Angeles County Dept. of Public Works
Ed Aldridge	City of Long Beach, Dept. of Public Works
Dennis Eschen	City of Long Beach Parks, Recreation and Marine
Leslie Hunsaker	City of Long Beach Parks, Recreation and Marine
Warren Liff	Aquarium of the Pacific
Nancy Matsumoto	Water Replenishment District of Southern California
Isaac Pai	City of Long Beach Water Dept.
Karen Bane	California Coastal Conservancy

TAC Meeting No. 1

In summary, the TAC meeting discussions at the first TAC meeting and site walk included the following:

- The general habitat objectives and the need for additional water to accomplish those objectives, were discussed. This included the need to create habitats that would support rare species not presently having extensive habitat opportunities in the area, including riparian habitat, dune grasslands, brackish marsh, and aquatic systems free from exotic species.

- Water sources were discussed, including a summary of potential water available from the California Department of Transportation (Caltrans) Highway 105 Project, which involves unanticipated groundwater pumping and the need for disposal of this water to provide Caltrans credit for withdrawals from an adjudicated basin.
- Water-quality issues and concerns from the water supplies were discussed, as well as the potential for contaminant reduction in the wetland and subsequent use of the water including landscape irrigation and recharge.
- Habitat objectives specific for the DeForest Site were discussed, including a mosaic of marsh and riparian woodland, along with dune or scrub upland habitats, and the need to replace the existing non-native woodland with natives.
- Options for public use and security concerns, and trash/contaminant screening were discussed, to create a site that was more aesthetically pleasing and secure.

TAC Meeting No. 2

To summarize the second TAC meeting, CH2M HILL and Lynn Capouya, Inc. provided an initial overview of data collection, summarized opportunities and constraints, and discussed initial restoration concepts. The subsequent TAC discussion focused on identifying missing/inadequate data, preliminary project concepts, identifying preferred concept alternatives, and providing direction in alternative development. Key concerns expressed include the following:

- Treatment of Los Angeles River water should occur early in the wetland, and plants may have to be harvested and disposed of if metals prove to be a problem.
- Water supplies were discussed, but it is evident that the final water supply issues would not be resolved in the timeframe of this Study.
- Large and interconnected habitats are important for biological resources, but small postage stamp sized parcels may benefit some types of species better than others; for example, riparian birds are territorial, and may benefit less to small habitats than wetland birds, which typically nest colonially.
- A mosaic of open habitats would be preferable, with ample complexity and terracing along vegetative gradients both longitudinally and laterally; it should not be assumed that wooded habitats would be most preferable; scrub and open areas may support many rare species.
- The existing community forest at the DeForest Site should be thinned and replaced with natives, but not removed.
- Water catchment basins resulting from longer stormwater retention would have standing water that would not necessarily provide quality habitat, and would be challenging to implement while maintaining flood storage capacity.
- Preferable visitor center site would be at DeForest near the current nature trail entrance.

- Given the small size of the Sixth Street Site, habitat benefits would be very limited, and only interesting to biologists if brackish/salt marsh could be created there; even a small salt marsh would be viable, and valuable as a pocket of any size, since shorebirds can travel long distances.

- The cost per acre may be prohibitive for Sixth Street tidal marsh, given the small size available and the extent of infrastructure conflict and grading. However, since land costs are very high in the area, and since the land would not require purchase, the site may become more cost effective. It may also be more cost effective if additional acreage could be added in adjacent areas, which the City is exploring.

Conceptual alternatives were summarized to include the following. For DeForest Site: (1) slightly augmented flows with enhanced existing habitat; (2) water treatment alternative for reuse with the source of water being diverted storm water and LA River water; and (3) maximum water alternative for pass through to Dominguez Gap for recharge. For Sixth Street Site: (1) at grade revegetation with native scrub and/or tree species for rest stop; (2) pump-supplied freshwater wetland using augmented or existing storm water; and (3) excavated and designed for tidal connection for salt/brackish marsh.

TAC Meeting No. 3

The third TAC meeting on April 8, 2002 was held to present the results of the study and the three alternatives developed for each site, and to solicit TAC input. The comments received included:

DeForest

- Concern was expressed over the ability to balance location of the sites in an urban setting and planned public uses with successful wildlife habitat. Solutions offered included:
  - Use designs that consider horizontal and vertical separation of public access from wildlife use areas and use of viewing nodes that provide visual but not physical access;
  - Use of water features and dense vegetated buffers to limit access to interior of the habitat area;
  - Posted no dogs, mountain or dirt bikes
  - Educational signage and onsite docents to promote site care
  - Feral cat and dog control
  - Diligent security patrols to discourage homeless encampments

- Greater bird population establishment will come from creating more wetlands than from creating more riparian forest. There just is not an extensive enough area to create the size of forest needed to attract the sensitive riparian bird species. Where riparian forest is created an open forest is preferred over dense forest.

- Water sources:
  - LA River water may be fluctuating in available amount over time as upstream uses increase. Consider in future planning a habitat that can evolve over time from wetland to less water intensive riparian.

  - Interstate 105 water is still available. Use of I-105 water at DeForest with pass through to Dominguez Gap would require extensive site grading as proposed for Alternative 3. The Water Replenishment District was asked to discuss with Caltrans their willingness to contribute to the cost of this additional grading.

- North Long Beach Redevelopment Project representative expresses support for large visitor center but concern over large parking lot at DeForest. The City offered to consider a permeable surface parking lot.
- In general the TAC preferred Alternative 3, the maximum wetland/riparian alternative.

6th Street Bridge

- Interest was expressed in establishing salt marsh or brackish marsh habitat at the site even if small.
- Future expansion of salt/brackish marsh habitat to the north of the site may be possible making a connection with the tidally influenced LA River at this site more attractive.

Public Meetings

Public Meeting No. 1

A public meeting was conducted on August 8, 2001. In summary, meeting content and public discussions at the first public meeting included the following:

- Jerry Schultz of the Long Beach City Council provided an overview of the development of the existing DeForest Nature Park, including volunteer coordination in procuring and planting trees.
- CH2M HILL provided a general presentation addressing the overall objectives and scope of the Study, and the wider objectives of restoration along the Los Angeles River.
- Information on groundwater recharge in the DeForest Site was provided, and the outcome of the water applied to the basin was discussed, including recharge using percolation pits or injection wells, or discharge to the Los Angeles River.
- Methods of vector management were discussed, including chemical or natural means using mosquitofish (non-native) or introduction of native species. The public was concerned about stagnant or standing water. Although more water would be on the site, in general, it would be flowing.
- Questions about the site limits and specific site boundaries were addressed.
- The Study schedule and project funding were addressed. The project is not a mitigation project and will not be formulated to conform to specific mitigation issues. The Study would open up additional opportunities for project funding.
- Questions about the types of habitat, species diversity, invertebrate populations, and creation of a bird sanctuary to protect wildlife were addressed.
- Questions about trash and site water quality were addressed.

Public Meeting No. 2

The second public meeting on April 8, 2002 was held to present the results of the study and the three alternatives developed for each site. The comments received included:

DeForest

- Consider "green" alternatives for the visitor center complex such as composting toilets, solar power, permeable surfaces for parking lots, earth covered or sod roof, and recycled materials.
- Consider safety measures such as an auxiliary ranger station at the south end of the site; site fencing, and full-time ranger presence at the site.
- Consider the phase out over time of non-native trees to preserve important bird habitat.
- Consider adding a picnic area for school groups at the entry point(s), possibly near Sutter School; and add public access restrooms at all entry points.
- Visitor Center:
  - Concern expressed over the size of the center at a natural area.
  - Recommended that most of the center be outdoors, possibly convert a classroom to an outdoor pavilion
  - Include minor kitchen facilities
- Landscape screening of the mobile home park and aggressive trash control will improve aesthetics of the site.

6th Street

- Important to consider maximizing access to the site. There is no parking near the site so consideration should be given to using Chavez Park and Edison School as assembly areas with pedestrian connections to 6th Street.
- Consider relocating the river trash boom upstream of the site if the tidal connection option is pursued and including a trash device with any tidal inlet.
- Salt/brackish marsh habitat option is less desirable than the back dune scrub habitat which is a very rare habitat in the area.
- For both sites consider maximizing the amount of matching grants that can be secured to fund the project.

1.1.5 Client Coordination

Additional client coordination regarding conceptual designs occurred through phone calls and emails after the December TAC meeting. Key decisions affecting conceptual designs include the following:

- Alternative 1 would not involve any water augmentation, and questions about water sources for the other alternatives, including evaluating new water sources, would not be addressed in alternative development.
- Questions about the treatment capacity of the DeForest Site, particularly given the limited area proposed for treatment marsh (south only to the MSPS), were raised. To

address these concerns, CH2M HILL would be evaluating treatment capacity up to the MSPS given the treatment alternative design, and evaluating treatment capacity of the entire basin given available acreage, without developing treatment designs south of the MSPS.

- Use of a sea wall or crib wall at the Sixth Street Site would increase the available area for wetland development. Concerns for the lack of an upland transition, the limited access for public to the marsh, higher costs, and applicability of this design to adjoining sites were addressed.
- Pocket parks have been proposed and designed for many locations along the Los Angeles River; this would be an appropriate development for Sixth Street Site, and models for this are being explored by Lynn Capouya, Inc.

1.1.6 Project Sites

DeForest Nature Center Site

The DeForest Site is a long, linear parcel encompassing approximately 15 hectares (38 acres) along the Los Angeles River in the City of Long Beach (Figure 1-2). This site is considered part of the LACDPW Dominguez Gap Spreading Grounds, sometimes referred to as the Debris Basin or Detention Basin in this context (WRD, 2001a). It lies on a north-south axis, extending about 2,010 meters (6,600 feet) between the developed DeForest Park to the north and Del Amo Boulevard to the south. The site is approximately 90 meters (300 feet) wide, and is bordered on the west side by the Los Angeles River levee, which effectively isolates the site from the river. The levee is about 7.6 meters (25 feet) above the river channel in this location, and is topped by the regional mountains to ocean LARIO bicycle trail. The river itself is lined with concrete along this reach; the low-flow channel has water year-round, supplied by discharge from two upstream water treatment plants. East of the DeForest Site are residential neighborhoods, including a trailer park and an elementary school.

For the purposes of this Study, the area within the DeForest Site north of North Long Beach Boulevard, which crosses the site at a diagonal, is referred to as the North Basin, the area south of North Long Beach Boulevard but north of the Market Street Pump Station (MSPS) is referred to as the Central Basin (formerly referred to as North South Basin in the *Task 3 Report*), and the area south of the MSPS and north of Del Amo Boulevard is referred to as the South Basin (formerly referred to as South South Basin in the *Task 3 Report*). The basins are not separated hydrologically; the MSPS is the low point, and in general, water flows from the North Basin to the Central Basin and on to the MSPS, and from the South Basin to the MSPS. The North Basin is the location of the DeForest Nature Center, which consists of an extensive area of planted woodland, dense in some locations, and a well-used nature trail. The planted woodland is a mix of native and non-native species. Two storm drains, operated by LACDPW, are located at the north end of the North Basin and discharge enough year-round water to support an emergent wetland that runs the length of the North Basin. Just to the north of the DeForest Site is the developed DeForest Park, which consists of active sports fields and landscaped park areas.

The Central and South Basins consist of more open and ruderal land cover, with only scattered trees and shrubs. Some native vegetation is present, as well as stands of non-native ornamental trees planted on the perimeter of the basin adjacent to residential areas.

A storm drain outlet and the MSPS are present between the Central and South Basins, and are operated by LACDPW. Water flows to the MSPS from both the south and north ends of the basin, as well as from the Market Street Storm Drain, before being pumped out to the Los Angeles River. The entire DeForest Site is used by the LACDPW as a holding basin for flood detention for stormwater runoff from adjacent residential neighborhoods.

South of the DeForest Site, just south of Del Amo Boulevard, is the East Basin of the Dominguez Gap Spreading Grounds, operated by the LACDPW. Low-flow runoff from the Los Angeles River is currently diverted to the East Basin for storage and groundwater recharge purposes; the basin also receives local uncontrolled stormwater runoff. Overflow from the East Basin is either pumped to the Los Angeles River by the Dominguez Gap Pump Station, or retained and ultimately diverted through a 41-inch siphon to the West Basin of Dominguez Gap Spreading Grounds on the west side of the Los Angeles River for groundwater recharge.

Sixth Street Bridge Site

The Sixth Street Site is about 1.6 hectares (4 acres), and is located adjacent to the Los Angeles River about 10 kilometers (6 miles) downstream from the DeForest Site, and about 3 kilometers (2 miles) upstream from the river's mouth at the Pacific Ocean (Figure 1-3). It lies just south of the Shoemaker Bridge overpass, where the 710 Freeway empties out onto Shoreline Drive and Sixth Street in Long Beach. As such, it is surrounded on three sides by roadway, including the bridge overpass on the north, and the Sixth Street and Shoreline Drive offramps on the east and south. In addition, a presently unused underpass from Seventh Street, and an unused onramp to Shoreline Drive, are located in the south center of the site. The Los Angeles River Levee lies along the western boundary of the site. The top of the levee is on average about 3 meters (10 feet) above the site, with the top of the levee about 6 meters (20 feet) above the mean water level in the river. The river is tidally influenced and brackish at this location.

The Sixth Street Pump Station operated by the City is located in the center of the site. This station delivers stormwater from City streets to the Los Angeles River. Areas surrounding the pump station, and covering a large portion of the site, are disturbed and largely unvegetated. Vegetation does occur in the southern portion of the site, along the Los Angeles River levee, and along the Shoreline Drive offramp. This consists of natural/semi-natural vegetation, landscaped areas with ornamental trees, and revegetated areas apparently planted with native species. A small wetland area occurs on the south of the site, watered from surface runoff, and supporting a stand of cattail (*Typha* sp.).

Additional land use in the area includes the Cesar E. Chavez city park to the southeast, a school directly to the east across Shoreline Drive, county bus facility, and other light industrial uses to the north. An unused vacant lot lies just north of the Shoemaker Bridge, and is continuous with the DeForest Site under the bridge overpass.

1.1.7 Report Organization

This report is divided into six Sections. Section 1.0 addresses introductory information on the Study objectives and the subject sites, and the general Study approach. Section 2.0 provides a summary review of the most pertinent data collected during Task 3, which included regional and site specific data collection and opportunity/constraints analysis

relative to habitat restoration and public use on the two sites. Section 3.0 provides a summary review of the conceptual alternatives developed under Task 5 of the Study, which includes three conceptual alternatives for each Study site; these alternatives were designed based on Study objectives, the findings in Task 3, and TAC, Public, and client input. Section 4.0 provides a summary review of Task 7 of the Study, which involved the benchscale development and analysis of treatment wetland options for the DeForest Site. Section 5.0 provides recommendations for further study and the next steps in project implementation. Section 6.0 provides references and a project bibliography.

Figures – Section 1.0

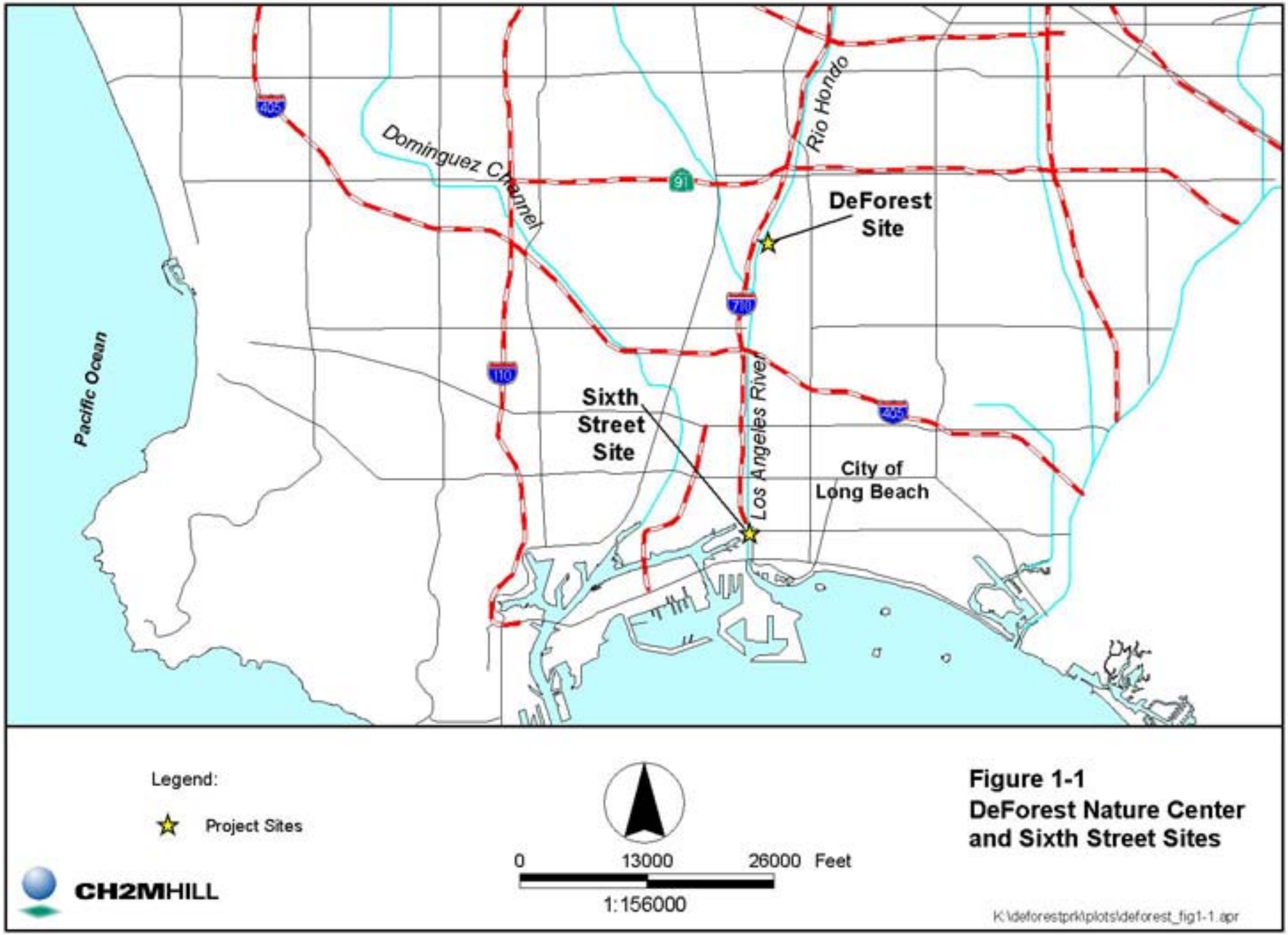
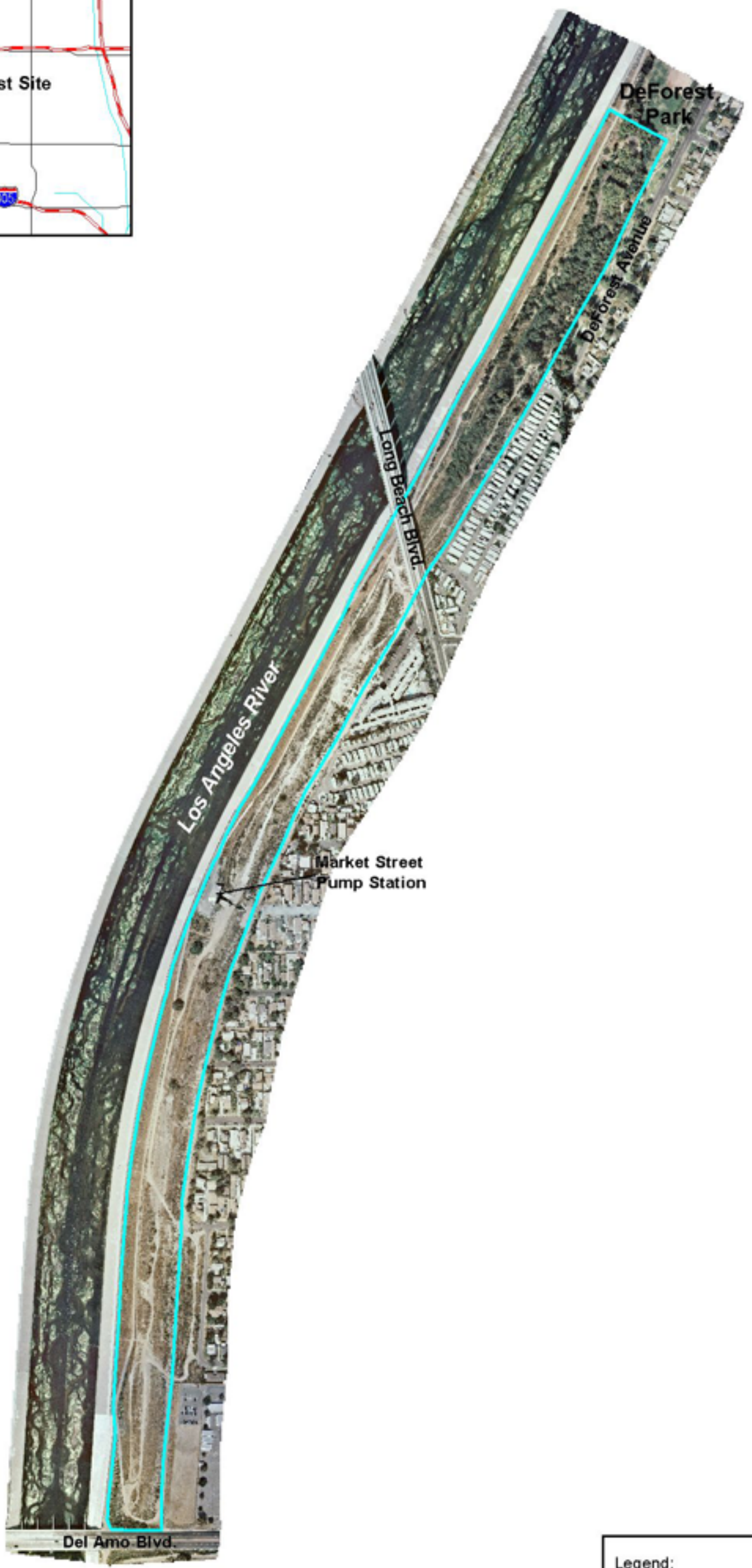


Figure 1-1
DeForest Nature Center and Sixth Street Sites



Legend:

DeForest Nature Center Site

0 500 1000 Feet

1:6000

Figure 1-2
DeForest Nature Center Site Map
DeForest Nature Center Site

CH2MHILL

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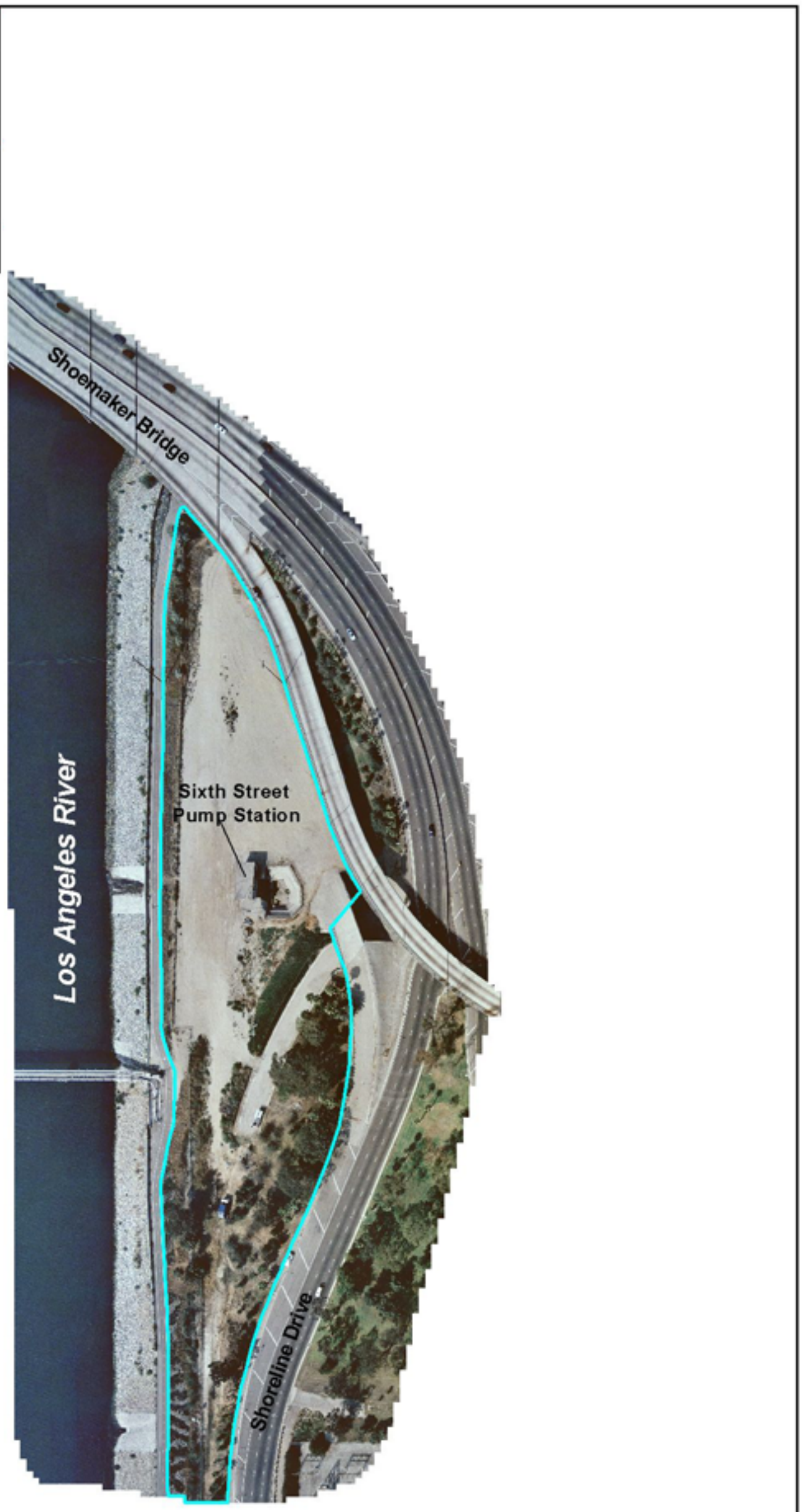

Legend:

Sixth Street Site

CH2MHILL

0 150 300 Feet

1:1800

Figure 1-3
Sixth Street Site Map
Sixth Street Site

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2.0 Existing Conditions and Opportunities and Constraints

2.1 General Regional Setting

2.1.1 Los Angeles River Basin

Physical Environment

The Study sites are located in the Los Angeles Basin, a broad geographic area in semi-arid Southern California loosely characterized as the low elevation, urban developed areas within the Los Angeles River Watershed. The Los Angeles River Watershed covers a land area of over 2,070 kilometers squared (8oo square miles), from the eastern portions of Santa Monica Mountains, Simi Hills, and Santa Susana Mountains to the San Gabriel Mountains in the west. The watershed encompasses and is shaped by the path of the Los Angeles River, which flows from its headwaters in the mountains, south and east through the San Fernando Valley, south through the Glendale Narrows, and out into the relatively flat coastal plain to the river mouth in San Pedro Bay near Long Beach. Over its length, the river drops more than 2,133 meters (7,000 feet) from the San Gabriel and San Fernando Mountains to the valley and coastal plain below. Much of the coastal plain is below about 240 meters (800 feet) elevation; the Study sites themselves are below 20 meters (65 feet) elevation.

Climate

Rainfall amounts vary in the region with an annual average of 91 centimeters (36 inches) falling in the mountainous areas and 33 centimeters (13 inches) along the coastal plain. For the low mountainous areas in the region the temperature ranges from a monthly average of 5 degrees Celsius (°C) (41 degrees Fahrenheit [°F]) in January to a monthly average of 22°C (72°F) in July. For the coastal plain, the temperature ranges from a monthly average of 12°C (53°F) in January to a monthly average of 20°C (68°F) in July. The mountains, which ring the valley and coastal plain, act to both create the temperate climate of the region by trapping ocean breezes, as well as to trap storms leading to rapid runoff and flooding in the valley. The runoff from rainfall in the mountains accounts for almost 75 percent of the total runoff in the region. Precipitation and temperature data were obtained for the Long Beach Weather Service Contract Meteorological Observatory (WSCMO) Station (National Oceanic and Atmospheric Administration [NOAA]). These data are shown in Table 2-1.

TABLE 2-1
Climate Data from the Long Beach WSCMO Station
Period of Record : 4/1/1958 to 12/31/2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
Average Max. Temperature (F)	66.9	67.5	68.3	72.0	73.6	77.3	82.6	84.3	82.5	78.4	72.2	67.4	74.4
Average Min. Temperature (F)	45.5	47.4	49.6	52.3	56.7	60.1	63.6	65.0	62.9	57.9	50.3	45.2	54.7
Average Total Precipitation (in.)	2.74	2.83	2.07	0.75	0.17	0.07	0.02	0.08	0.22	0.30	1.35	1.65	12.24

Pan evaporation data were obtained from the LACDPW for water years 1999 to 2000. The closest LACDPW evaporation monitoring location to the project area is Descanso Gardens, located in Pasadena. The monthly evaporation values are shown in Table 2-2.

Hydrology

The Los Angeles River, along much of its course, had intermittent flow during much of the year prior to channelization. In addition, many of its tributaries did not reach the river except during storm events. The current low flow in the river is effluent dominated with approximately 80 percent of its flow originating at treatment plants, and the remaining flow coming from storm drain runoff and shallow groundwater discharging at the surface in the Glendale Narrows area. Surface flow during storm events can be substantial, with flood events as high as 81,0000 cubic feet per second (cfs), which was recorded during the February to March, 1983 storm event at the Los Angles River below Wardlow Road. Mean monthly flow in the Los Angeles River recorded at U.S. Geological Survey (USGS) stations is presented in Table 2-3. This includes data from Station USGS111098500 and USGS11102500 located on the Los Angeles River and Rio Hondo, respectively, both about 1.6 kilometers (1 mile) above the confluence of these two waterways, and about 10 kilometers (6 miles) upstream from the DeForest Site. The combined flow of these two measurements would best represent the flow in the Los Angeles River adjacent to the DeForest Site. The data from USGS1103000 are downstream from the DeForest Site at West 33rd Street in Long Beach, and include flow from Compton Creek, which flows into the Los Angeles River just downstream of the DeForest Site. Flow in the Los Angeles River from Willow Street in Long Beach, just downstream of this gauge station, is tidally influenced and is, therefore, not gauged. This includes flow adjacent to the Sixth Street Site.

Additional surface water drainage in the vicinity of the project sites has been contained in stormwater systems developed and managed by the City and the LACDPW. These systems include outlets and pump stations managed by LACDPW in the DeForest Site, and an outlet and pump station managed by the City at the Sixth Street Site.

TABLE 2-2
LACDPW Pan Evaporation Data for Los Angeles County Locations, 1999-2000

Station Name	Evaporation (inches)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Pacoima Dam	13.54	7.41	8.93	4.87	4.17	5.63	7.65	7.32	8.61	10.08	10.70	9.98	98.85
Big Tujunga Dam	12.90	7.41	7.63	3.72	2.03	5.65	11.10	10.55	12.39	14.52	14.24	10.42	112.54
Santa Anita Dam	7.80	4.30	4.66	2.82	1.77	2.90	3.46	3.96	5.27	6.17	6.97	5.49	55.54
San Dimas Dam	4.91	1.95	2.31	2.75	1.62	2.69	6.28	5.35	7.35	8.73	8.48	6.15	58.54
Puddingstone Dam	6.53	3.30	3.39	2.14	1.67	3.50	4.91	6.05	7.25	8.38	8.86	6.49	62.43
Big Dalton Dam	5.79	2.63	2.95	1.54	1.15	2.59	3.43	5.09	6.50	7.76	7.43	5.23	52.05
Cogswell Dam	5.71	2.92	2.73	1.26	0.80	3.70	3.76	5.66	7.48	8.62	8.37	5.70	56.69
Morris Dam	8.93	5.52	5.44	4.81	13.08	8.48	11.09	8.67	10.08	11.28	11.62	9.86	108.85
San Gabriel Dam	8.28	4.72	3.96	2.84	2.27	4.33	5.37	6.29	7.93	9.40	8.84	7.92	72.12
Palmdale	N/A	3.23	N/A	2.23	2.26	4.02	N/A	N/A	11.60	12.43	12.41	N/A	----
Descanso Gardens	5.09	2.94	3.72	2.26	1.13	2.95	3.63	5.53	7.28	8.22	7.59	5.69	56.02

Urban Environment

The Los Angeles Basin has undergone major population growth and associated development since the 1940s, which has created a heavily urbanized area. The population of the region is over 9.9 million people and projected to expand to 11.5 million by 2020. The area has an extensive network of infrastructure composed of airports, roads (highways, freeways, and streets), railroads, domestic, recycled water, and sewage pipelines and facilities, power distribution lines, flood control structures, water conservation facilities, and other infrastructure components. The basin's population, climate, and topography have continued to create an environment with a unique set of problems including water supply issues, water quality degradation, flooding, habitat destruction, and a shortage of recreational and open space.

To address the problems caused by flooding and urbanization, an elaborate system of flood control measures was implemented on the Los Angeles River by the U.S. Army Corps of Engineers (USACE) and LACDPW between 1914 and 1970. Together with flood control measures on the nearby San Gabriel River Watershed, this constitutes the largest flood control system in the world. Included on both watersheds are over 160 kilometers (100 miles) of channel enlargement and reinforcement on the main rivers and their

TABLE 2-3
USGS Gauge Station Data of Mean Surface Flow in the Los Angeles River and Rio Hondo
All Flow Data in Cubic Feet per Second

Station	Location	Annual Mean	7-Q-10 Low Flow*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
USGS 111098500	Los Angeles River near Firestone Blvd., South Gate	122.7	1.35	280.7	361.2	317.9	102.8	35.7	21.2	19.1	21.5	27.9	25.4	122.3	161.2
USGS 11102500	Rio Hondo Between Firestone Blvd. and Southern, South Gate	35.8	0.00	91.8	121.9	128.0	27.4	5.45	1.34	1.01	1.33	2.30	1.97	27.7	27.3
Calculated	Sum Of USGS11109850 and USGS11102500	158.5	1.40	372.6	483.1	445.9	130.2	41.2	22.6	20.1	22.9	30.2	27.4	150.0	188.6
USGS 11103000	Lower Los Angeles River at W. 33rd, Long Beach	186.4	1.07	451.9	544.4	494.0	164.5	48.2	28.4	24.8	28.3	37.0	33.0	192.9	227.0

* Represents the lowest average flow for a seven-day period that is expected to occur once every ten years.

tributaries, 115 debris dams, 20 reservoirs, 32 groundwater recharge locations, and over 217 stabilization structures in over 47 sub-watersheds. The Los Angeles River has been transformed from a free-flowing meandering river to an efficient flood control structure by encasing its channel in reinforcement along 77.1 kilometers (47.9 miles) of its 82.1 kilometer (51 mile) length. There are three stretches where the channel is not lined with concrete reinforcement. They are:

- Within the Sepulveda Flood Control Basin
- Through the Glendale Narrows
- South of Willow Street in Long Beach

2.1.2 Planning Efforts

Los Angeles River Master Plan

The Los Angeles River Master Plan (LARMP), completed in 1996 by the Regional Planning and Parks and Recreation; the National Parks Service; and the Master Plan Advisory Committee, identified the Los Angeles River as a potential aesthetic, recreational, economic development and educational resource of regional importance. The LARMP is essentially a "vision" document that looks at revitalizing the river as "a resource that provides flood protection and opportunities for recreational and environmental enhancement, improves the aesthetics of the region, enriches the quality of life for residents, and helps sustain the economy of the region." General recommendations of the LARMP include a uniform regional mapping and sign system; enhancement programs at trail entrances; and development of a series of interpretive sites that would "tell the story of development along the entire river." Within the City of Long Beach, the LARMP includes encouraging the development of recreation-related sales and business opportunities near DeForest Park; developing restoration, educational and interpretive sites at Dominguez Gap and near schools; and creating a greenway from Queensway Bay to DeForest Park. The greenway is envisioned as a continuous planting of trees along the river for increased cooling, and for forage, roosting and nesting habitat.

Los Angeles River Bicycle Trail

The Los Angeles River Bicycle (LARIO) Trail is a regional trail system that leads north from the mouth of the Los Angeles River along the east levee past both the Sixth Street Site and the DeForest Site, then northeast along the Rio Hondo Channel to Whittier Narrows Dam. Here it connects with the San Gabriel River Trail, which provides a link northward to the mountains. Along the east Los Angeles River levee, including the areas contiguous to both DeForest Park and the Sixth Street Site, LARIO trail improvements were completed in 1999 that included bike trail paving, aesthetic treatments, and landscaping.

City of Long Beach Strategic Plan

The City of Long Beach Strategic Plan, published in January 2001, envisions the City as "a community of neighborhoods focused on youth and education, with safety and economic opportunity for all, and a responsive, accountable government, in a healthy, green environment." Sustainability is embraced as a basic guiding precept. Specific goals for a healthy environment include enhancing open space and improving water resource management, including the restoration of wetlands and riparian habitat.

2.1.3 Water Quality

Stormwater Quality

The City is required to conduct a water-quality monitoring program for stormwater and dry weather discharges through the City's municipal separate storm sewer system. The City's monitoring program calls for monitoring mass emissions and toxicity at four representative mass emissions locations, including the Dominguez Gap Pump Station. The Deforest Site is contained within the basin that the Dominguez Gap monitoring location represents. A summary of water quality from the Domiguez Gap monitoring location for 1999 to 2000 is presented in Table 2-4.

TABLE 2-4
Dominguez Gap Pump Station Stormwater Monitoring Results for 1999 – 2000

Class Constituent	RL	Units	Mean
Indicator Bacteria			
Total Coliform	2.0	MPN/100ml	84,186
Fecal Coliform	2.0	MPN/100ml	11,375
General Minerals			
BOD	10.0	mg/L	S.I.D.
pH	0 – 14	Units	6.9
Total Suspended Solids	1.0	mg/L	44
Turbidity	0.1	NTU	69
Nutrients			
NH_3-N	0.1	mg/L	0.25
Nitrate-N	0.01	mg/L	0.24
Nitrite-N	0.2	mg/L	S.I.D.
Dissolved Phosphorus	0.001	mg/L	0.28
Total Phosphorus	0.002	mg/L	0.44
TKN	0.1	mg/L	0.91
Metals			
Dissolved Aluminum	25-50	µg/L	208
Total Aluminum	25-50	µg/L	1681
Dissolved Copper	1.0-10	µg/L	7.0
Total Copper	1.0-10	µg/L	14.0
Dissolved Arsenic	0.5	µg/L	1.6
Total Arsenic	0.5	µg/L	2.1
Dissolved Chromium	1	µg/L	S.I.D.
Total Chromium	1	µg/L	2.0
Dissolved Iron	25-50	µg/L	126
Total Iron	25-50	mg/L	1588
Dissolved Lead	1	µg/L	S.I.D.
Total Lead	1	mg/L	11
Pesticides			
2,4-D	0.2-2.0	µg/L	S.I.D.

TABLE 2-4
Dominguez Gap Pump Station Stormwater Monitoring Results for 1999 – 2000

Class Constituent	RL	Units	Mean
2,4,5-TP	0.2-0.5	µg/L	S.I.D.
Bentazon	1.0-20.0	µg/L	S.I.D.
Carbofuran	10	µg/L	S.I.D.
Diazinon	0.01-1.0	µg/L	S.I.D.
Glyphosate	5-10	µg/L	S.I.D.

S.I.D. = Statistically Invalid Data, not enough data above detection limit collected
Source: Los Angeles County Department of Public Works Website, http://ladpw.org/wmd/npdes/9400_tbl_list.cfm

Los Angeles River Water Quality

The Los Angeles River Watershed has a number of water-quality impairments in the middle and lower portions of the watershed due to runoff from dense clusters of commercial, industrial, residential, and other urban activities. The 1998 303(d) list of impairments in a majority of the Watershed are due to point and nonpoint sources. These impairments include the following: pH, ammonia, a number of metals, coliform, trash, scum, algae, oil, and chorpyrifos, as well as other pesticides, and volatile organics. Overall water quality for the Los Angeles River is provided at a monitoring location along the Los Angles River between Wardlow Road and Willow Street; this data is summarized for 1999 to 2000, and provided in Table 2-5.

TABLE 2-5
Los Angeles River Water Quality Monitoring Results for 1999 – 2000

Class Constituent	DL	Units	Mean
Indicator Bacteria			
Total Coliform	20	MPN/100ml	1,608,889
Fecal Coliform	20	MPN/100ml	392,922
General Minerals			
BOD	2.0	mg/L	9.2
pH	0 – 14		6.9
Total Suspended Solids	2.0	mg/L	333
Turbidity	0.1	NTU	139
Nutrients			
NH_3-N	0.1	mg/L	0.14
Nitrate-N	0.1	mg/L	0.78
Nitrite-N	0.1	mg/L	0.13
Dissolved Phosphorus	0.05	mg/L	0.30
Total Phosphorus	0.05	mg/L	0.41
TKN	0.1	mg/L	2.4
Metals			
Dissolved Aluminum	100	mg/L	339
Total Aluminum	100	µg/L	503

TABLE 2-5
Los Angeles River Water Quality Monitoring Results for 1999 – 2000

Class Constituent	DL	Units	Mean
Dissolved Barium	10	µg/L	27
Total Barium	10	µg/L	38
Dissolved Boron	100	µg/L	90
Total Boron	100	µg/L	128
Dissolved Copper	5	µg/L	5.8
Total Copper	5	µg/L	12.5
Dissolved Iron	100	µg/L	191
Total Iron	100	µg/L	443
Dissolved Lead	5	µg/L	3.2
Total Lead	5	µg/L	9.1
Pesticides			
2,4-D	10	µg/L	S.I.D.
2,4,5-TP	1	µg/L	S.I.D.
Bentazon	2	µg/L	S.I.D.
Carbofuran	5	µg/L	< MDL
Chloropyrifos	0.05	µg/L	< MDL
Diazinon	0.01	µg/L	< MDL
Glyphosate	25	µg/L	< MDL

S.I.D. = Statistically Invalid Data, not enough data above detection limit collected
Source: Los Angeles County Department of Public Works Website, http://ladpw.org/wmd/npdes/9400_tbl_list.cfm

2.1.4 Regulatory Setting

The following regulations are identified as relevant to potential project implementation at the subject sites. While generally, resource agencies are favorably disposed toward restoration projects, some regulations may require appropriate environmental documentation and permit acquisition prior to project implementation. The development of the DeForest and Sixth Street Sites into multipurpose wetland parks is consistent with current county and city land use designations and with the Los Angeles River Master Plan. Regulatory approval and environmental documentation could be required by the following governing agencies and laws:

- U.S. Army Corps of Engineers – Section 404 of the Clean Water Act, requiring Section 404 Permit
- U.S. National Marine Fisheries Service – Commenting agency on Section 404 Permit
- U.S. Environmental Protection Agency – Commenting agency on Section 404 Permit
- U.S. Fish and Wildlife Service – Section 7 and/or Section 10 of the Endangered Species Act
- California Department of Fish and Game – Fish and Game Code Section 1600

- California Regional Water Quality Control Board – Section 401 (Clean Water Act) Water Quality Certification
- Department of Health and Safety Title 22 Regulations
- California State Water Resources Control Board- Water Rights for Los Angeles River water
- California State Historic Preservation Office – Section 106, National Historic Preservation Act
- Los Angeles County Department of Public Works – grading, encroachment, and building permits
- California Environmental Quality Act - compliance documentation, which may include an Environmental Impact Report (EIR)

Cumulatively, the required approvals and California Environmental Quality Act (CEQA) compliance process can reasonably be expected to take up to one year or more to complete, but do not seem atypical, and therefore do not appear to impose an unusual requirement on this project. A more complete summary of regulatory approvals and permits potentially required for project implementation is provided in the *Task 3 Report*.

2.2 Regional Biological Conditions

2.2.1 Historical Conditions

Historic records and photographs from early explorers and settlers to the Los Angeles Basin have provided a clear picture of conditions prior to the substantial development, urbanization, and river channelization of the 20th Century. An excellent summary of these records are provided in Gumprecht (1999). The historic picture of the Los Angeles Basin, and particularly the coastal plain, is one of a rich, well-watered landscape, filled with dense riparian vegetation and wetlands, with a frequently changing alluvial landscape dominated by the Los Angeles River. The river itself varied from perennial flow in most years, to intermittent flow in dry years. Large flood events would frequently reshape the shallow braided channel, overflowing banks, and at times completely redirecting the river's flow. This resulted in the mouth of the Los Angeles River changing from time to time, even meandering as far west as Santa Monica Bay, along the present course of Ballona Creek.

By some estimates, as much as 70 percent of low-lying areas in the Los Angeles Basin south of Glendale Narrows were subject to periodic inundation by large flood events (Gumprecht, 1999). The broad floodplain that resulted from these erratic flood flows supported a remarkable diversity of habitats. The frequent disturbances resulted in varying stages of ecological succession, with early seral stages represented by colonizing herbaceous and woody plants on scoured alluvial surfaces, including dense thickets of willows, and later seral stages represented by gallery cottonwood forests or higher on the river in the San Fernando Valley, by oak and walnut forests. In many locations, riparian woodlands developed dense undergrowth of elderberry, wild grape, and other shrubs and vines; early reports indicate that much of the lower river basin was covered by these dense woodlands

and thickets, and was impenetrable except for a few trails. Sycamore forests were less common, but developed as open woodlands on higher alluvial terraces.

Overflow from the river spread out over the landscape and joined with springs from the surrounding hills to form vast marshes, shallow lakes, and small ponds. Cattails, bulrush, and other marsh vegetation thrived in sloughs and open wetlands, as well as in boggy locations at spring discharge sites in the low mountains. As the river neared its various outlets to the sea, there were extensive areas of salt and brackish marsh. Open lagoons, salt marsh, and mud flats were continuous from the river's mouth just south of San Pedro to the mouths of the San Gabriel and Santa Ana Rivers in present day Orange County.

Higher areas of the coastal plain were occupied by scattered willow forests, emergent marsh in wet areas, and open native bunch grass or scrub in drier areas. Vernal pools were occasionally present in low swales and depressions where soil conditions were suitable. Scrub and grassland habitats occurred in extensive dunes along coastal beaches. On dry slopes in the low mountains surrounding the coastal plain, coastal sage scrub was predominant, and riparian areas with perennial flow were represented by willow forests. Drier riparian sites were represented by sycamore, oak, and walnut woodlands; in addition, some cool north slopes supported oak and walnut woodlands. In the upper reaches of the Los Angeles River, where flooding was less frequent, sycamores, oaks, and walnut woodlands were more common on alluvial terraces. Uplands were covered with yucca, cactus, juniper, and other species more characteristic of alluvial fan scrub.

Historic Vegetation and Wildlife Communities

This section presents more detailed information on historical habitats occurring in the lower Los Angeles River Watershed. This information is provided with the critical understanding that the Study objective is to target restoration of historic habitats, and to evaluate the site-specific suitability for these habitats.

Salt/Brackish Marsh

Salt/brackish marshes are located within areas susceptible to tidal inundation with saltwater. Specific plant species that occur within this environment can tolerate varying levels of salinity and are distributed along salinity gradients within the marsh system. Species may include estuary sea-blite (*Suaeda esteroa*), pickleweed (*Salicornia* spp.), Coulter's goldfields (*Lasthenia glabrata*), toad rush (*Juncus bufonius*), and alkali weed (*Cressa truxillensis*). Salt marshes can be located directly along the coastline, or in areas of stream or river convergence upstream to the limits of salt intrusion. Along the banks of tidally influenced rivers, salinity gradients determine plant community constituents and vary from species tolerant of seawater at 35 parts per thousand (ppt) along the coast to those species considered brackish with little to minimal salinity concentrations upstream.

Salt and brackish marshes were once widespread along the coastlines of Southern California, including in the vicinity of the present-day Sixth Street Site (SLC, 2001). Coastline development including marinas, residential, and commercial areas has eliminated all but a small remnant of historical coastal marshes. Many remaining coastal wetlands in Los Angeles County are also degraded, affected by urban runoff, transportation and utility corridors, and, in some cases, oil wells (Zedler, 2001). Within Los Angeles County, remaining extensive salt marshes occur at Ormond Beach, Mugu Lagoon, Malibu Lagoon, Bolsa Chica, and Ballona wetland (McAuley, 1996; Zedler, 2001). Salt and brackish marshes

are expected to have occurred at the mouth of the Los Angeles River in Long Beach. Depending on the level of salt intrusion into the river channel, brackish species could have been expected to occur up to the current Sixth Street Site.

Freshwater Emergent Wetland

Freshwater emergent wetlands occur within areas of shallow, permanent or semipermanent inundation, often located in topographical depressions or directly adjacent to perennial stream or river courses. In riverine systems, these areas are usually not influenced by direct flow, but receive water distributed onto adjacent flats. Species include bulrush (*Scirpus* spp.), cattail (*Typha* spp.), tall flatsedge (*Cyperus eragrostis*), duckweed (*Lemna* sp.), sedge (*Carex* sp.), rush (*Juncus* sp.), and others. Some wetland plant species are not adapted to tolerate inundation, but provide vegetative cover along the transitional areas between emergent wetlands and adjacent uplands. These are often annual plant species that provide significant food sources to resident or migratory bird and waterfowl species.

Freshwater emergent wetlands were once present within the extensive floodplain of the river, and extended from Los Angeles to the Pacific Ocean (Gumprecht, 1999). These areas were created by overflow of the Los Angeles River, as well as areas where river water was pushed to the soil surface because of geologic features. The variations of the course of the river provided a distribution of these habitats over a large expanse of the floodplain. Historic emergent wetlands were once located at the present Fifth Street in downtown Los Angeles, the east side of the River near Boyle Heights, north of the confluence of the river and the Rio Hondo, as well as in locations in Lynwood and an area west of Compton (Gumprecht, 1999). It is likely that patches or extensive areas of emergent marsh were also present along the Los Angeles River course in what is now Long Beach.

River Riparian Forest and Scrub

River riparian habitats flank riverine systems on either bank and develop dense deciduous scrub and tree canopies. Broad floodplains develop expansive riparian habitats, while narrow channels limit the extent of the riparian development (Ornduff, 1974). Plant species common to riparian habitats are capable to tolerate excessive soil moisture, and in some cases, inundated conditions (Faber et al., 1989). Tall, deciduous trees dominate the overstory canopy, with dense shrub and herbaceous growth below. Species include red willow (*Salix laevigata*), yellow willow (*S. lasiandra*), Goodding's willow (*S. gooddingii*), arroyo willow (*S. lasiolepis*), Fremont cottonwood (*Populus fremontii*), western sycamore (*Platanus racemosa*), white alder (*Alnus rhombifolia*), wild grape (*Vitus californica*), California wild rose (*Rosa californica*), and others. This community regenerates under a disturbance regime in river floodplains, and has a reduced capacity to regenerate when flow regimes have been altered through flood control facilities, or channel morphology altered with channelization or levees.

Riparian habitats in Los Angeles County were widespread within the River floodplain, often developing a dense thickets of vegetation that were impenetrable. These were the conditions described for the Long Beach area by early settlers (Gumprecht, 1999), and would have likely characterized river channels in the vicinity of the DeForest Site. As the channelization of the river progressed, large expanses of riparian vegetation was removed to provide area for urbanization. A network of park systems were proposed in the 1930s by Olmstead and Bartholomew, and if implemented, this would have preserved a component of the Los Angeles River and these adjacent riparian habitats (Hise and Deverall, 2000). This plan

was not implemented and, as a result of urbanization, very limited riparian habitats are present within the historic floodplain of the Los Angeles River. These are often extremely limited within Los Angeles County and occur within unchannelized and soft bottom reaches of the Los Angeles River, the Sepulveda Flood Control Basin, canyons of the Santa Monica Mountains, and areas alongside the San Gabriel River.

Sycamore Alluvial Woodland

The alluvial terrace open woodland plant community occurs within the foothills along seasonal, alluvial systems with the habit consisting of open, braided, depositional channels with a rocky or cobble substrate. The canopy of this woodland is generally more open than the dense, wetter riparian woodlands in lowlands, and contains some species common to both riparian and oak woodlands, including western sycamore, coast live oak (*Quercus agrifolia*), mulefat (*Baccharis salicifolia*), California buckeye (*Aesculus californica*), Mexican elderberry (*Sambucus mexicana*), and California sagebrush (*Artemisia californica*). These communities are typically drier than riparian systems and do not support the dense understory common to riparian systems, but do have a scattered low shrub cover.

Sycamore alluvial woodland historically occurred throughout the low foothills on intermittent streams, and still occurs where development has not encroached. Alluvial systems with the potential for their current or historic occurrence include subterranean reaches of the Los Angeles River, Verdugo wash, Arroyo Seco, Tujunga Wash, and Pacoima Wash. On floodplains on lower reaches of streams and tributaries in the Los Angeles Basin where sediments are finer and flows more likely to be perennial, this habitat is less likely to persist, but is replaced by riparian forests.

Vernal Pools

Vernal pools are classified as seasonal depressional wetlands within an area of undulating microtopography. An impervious substrate, usually a clay lens, captures winter surface precipitation, creating a perched water table that evaporates with elevating spring temperatures (Zedler, 1987). The area between pools is described as a playa, as increased precipitation can join adjacent pools. The depression of the pool may sustain branchiopod species (fairy shrimp) during winter flooding and establishes a specific suite of plant species exclusively associated with vernal pools (Zedler, 1987), including spreading navarretia (*Navarretia fossalis*), California orcutt grass (*Orcuttia californica*), *Psilocarpus* spp., *Plagiobothrys* spp., and alkali weed. Because the restricted nature of the range of these habitats and the few remaining occurrences present within Southern California, a number of the plant and animal species associated with vernal pools have a federal or state status of endangered or threatened.

Within Los Angeles County, the last remaining vernal pool complex is present within inland valleys and mesas at the Curzon Mesa, Santa Clarita (USFWS, 1997). Additional vernal pool complexes were once present within coastal terraces, valleys, and foothills of the Los Angeles Basin in what is present-day Downey, Lakewood, Rosecrans, Soldier's House, and where the Los Angeles Airport is currently located (USFWS, 1997). The resources once present at these sites are not well understood and are believed to have been extirpated prior to 1950 (USFWS, 1997). Vernal pools are currently extant within Santa Barbara, Ventura, Los Angeles, Orange, Riverside, and San Diego Counties in Southern California.

Perennial Grassland

Native perennial grasslands were nearly eliminated in California with non-native species introduced with European colonization, and now are reduced to remnant locations (see Huenneke, 1989). Non-native grasses fairly quickly dominated the landscape, and now make up most of the composition of remaining grasslands throughout the state. Historic grasslands in Southern California were dominated by perennial bunch grass species and native forbs, including purple needlegrass (*Nassella pulchra*), bluegrass (*Poa scabrella*), yarrow (*Achillea borealis*), owls clover (*Orthocarpus* spp.), and other native species. Now even remnants of historic bunchgrass communities have a number of introduced grasses and forbs typically present.

Currently, scientists disagree on the historical range of native grasslands within Southern California (Gumprecht, 1999; Keeley, 1989; USDA, 1988). In Los Angeles County, it is likely that upland areas within and adjacent to the Los Angeles River floodplain supported grassland habitats. Grassland sites had the potential to cover up to 40 percent of the noninundated, nonmountainous areas of Los Angeles County (Grumprecht, 1999). Presently within the county, a large 243 hectare (600 acre) needlegrass grassland community is located in La Jolla Valley.

Back Dune Scrub

This community historically occurred throughout Southern California coastal areas, generally within 8 kilometers (5 miles) from the ocean. It is sometimes called coastal strand. So little of this community remains, that floristic associations are not clear. Plants historically occurring in this community include scrub and herbaceous species that have the ability to generate deep taproots to attain the necessary moisture to sustain, and sometimes to develop nodule to fix atmospheric nitrogen and provide a sustainable nitrogen supply to the plant. These communities often establish plant species that also occur within coast sage scrub, although no sage (*Salvia* sp.) species are usually present. Typical species may have included beach saltbush (*Atriplex leucophylla*), branching phacelia (*Phacelia ramosissima* var. *austrolitoralis*), California ephedra (*Ephedra californica*), coastal locoweed (*Astragalus trichopodes* var. *lonchus*), dune buckwheat (*Eriogonum parviflorum*), and western prickly pear (*Opuntia littoralis*). Freshwater and vernal marshes often occurred in conjunction with back dune systems (CH2M HILL, 2001a). This community is also sometimes called coastal strand.

Historically, sand dunes were present in Los Angeles County in the El Segundo Sand Hills. The El Segundo Sand Hills were a series of stabilized dunes, parallel ridges, and aligned hills, formed in part from offshore bars that have been subjected to erosional processes since their emergence from the ocean at the end of the Pleistocene (Mitchell, 1981). These areas extended for approximately 19 kilometers (12 miles), 3 to 8 kilometers (2 to 5 miles) in width, adjacent to the coast from Ballona Escarpment to the Palos Verdes Hills (Mattoni et al. 1997; Mitchell, 1981). These dunes are approximately 45 meters (150 feet) thick and were composed of fine-to-medium grained sand (Mitchell, 1981). An example of this plant community was once present at the Madrona Marsh Preserve and is currently being restored (CH2M HILL, 2001a). Additional areas currently targeted for restoration of this plant community occur along Ballona Creek and adjacent bluff areas in Los Angeles County (CH2M HILL, 2001a). Small examples of this community persist in Baja California and the Channel Islands (Holland, 1986).

Alluvial Fan Scrub

Alluvial fan scrub habitats consists of open to dense, broad-leaved phreatophyte evergreen scrub along washes and braided seasonal alluvial systems, typically at the mouth of steep canyons. These communities often form the bridge between traditional riparian communities and coastal sage scrub habitat. These areas are susceptible to disturbance from washes as a result of precipitation events. Typical plant species include scalebroom (*Lepidospartum squamatum*), California sagebrush, Parish's sagebrush (*A. tridentata* ssp. *parishii*), mexican elderberry, and various coastal sage scrub and chaparral species.

Alluvial systems within Los Angeles County include Verdugo Wash, Arroyo Seco, Tujunga Wash, and Pacoima Wash. These areas, although not well documented, are suspected to have developed habitats of alluvial scrub vegetation in areas of frequent flood disturbance.

Coastal Sage Scrub

Coastal Sage Scrub occupies a narrow region along the coastward side of the South Coast Ranges and occurs on dry, steep, gravelly or rocky slopes below 914 meters (3,000 feet) (Ornduff, 1974). Plant species of this community are generally less than 1.8 meters (6 feet) in height, are seasonally dimorphic, and can tolerate summer drought (DeSimone, 1995). Typical plant species include California sage, brittlebrush (*Encelia farinosa*), California buckwheat (*Eriogonum fasciculatum*), white sage (*Salvia apiana*), purple sage (*S. leucophylla*), and black sage (*S. mellifera*).

Because of the lower elevation distribution of this plant community, it has been subject to degradation and clearing as urbanization has increased. In 1979, it was identified that 36 percent of potential coastal sage scrub habitat in California had been lost (DeSimone, 1995). Westmand in 1980 identified that as much as 90 percent of the community has been lost within California (O'Leary, 1995). Historically this community was widespread on coastal foothills and slopes in the Los Angeles Basin; however, it probably did not occur in the coastal plain to any great extent.

Walnut Woodland

Walnut woodland communities are restricted to Southern California and occur in the foothills and inland valleys in Ventura, Los Angeles and northern Orange Counties (Quinn, 1989). The California walnut (*Juglans californica*) is considered a component of other plant communities, including oak woodlands described below, but is also present in monotypic stands. Other species present may include coast live oak, poison oak (*Toxicodendron diversiloba*), California buckeye, and others. The presence of walnut woodlands are strongly correlated with the occurrence of steep, northward facing slopes with soils derived from Miocene-Pliocene marine shales (Quinn, 1989).

In Los Angeles County, walnut woodlands occur in stands on north facing slopes in the Santa Monica Mountains, Santa Susana Mountains, Simi Hills, Puente Hills, and San Jose Hills (Quinn, 1989). In 1934, a dense walnut woodland occurred for approximately 5 km (3 miles) along the north and northeast facing slopes of the San Jose Hills, at the edges of the current cities of Pomoma, Covina, Walnut, and La Verne (Quinn, 1989). This woodland was impacted by urbanization and small fragments of it persist.

Oak Woodland

Oak woodlands comprise groves open to locally dense woodlands dominated by coast live oak and associated understory on slopes and ridges throughout the mountain ranges in Southern California. Associate species may include California bay (*Umbellularia californica*), toyon (*Heteromeles arbutifolia*), coffeeberry (*Rhamnus californica*), sugar bush (*Rhus ovata*), and coastal woodfern (*Dryopteris arguta*). These communities sometimes replace riparian habitats on slopes adjacent to stream sites (McAuley, 1996). This community occurs on bottomlands and outer floodplain terraces outside of the influence of frequent scouring floods, generally along larger streams on fine-grained, rich alluvium. It may also occur on cool, north-facing slopes. The understory is typically rich in herbaceous growth, but with limited shrub growth.

Within the Santa Monica Mountains of Los Angeles County, this community is found in Upper Sycamore Canyon, Boney Mountain, Tapia Park, and Malibu Creek State Park (McAuley, 1996).

2.2.2 Existing Biological Conditions

Existing Vegetation and Wildlife Communities

Within the immediate study area, most native habitats are largely lost to urbanization. Both of the subject Study sites are dominated by the following: (1) ruderal, invasive species; (2) disturbed and compacted soils not supporting extensive vegetation; (3) ornamental or landscaped areas; (4) native riparian woodland or emergent wetland in small patches; or (5) developed roadways, levees, residential areas, or structures. The Wet Concrete Bottom habitat described by Garrett *ed.* (1993), has extensive representation in the Los Angeles River adjacent to the DeForest Site, and is heavily used by migrant shorebirds. The Brackish Channel Water habitat described by Garrett characterizes the Los Angeles River habitat adjacent to the Sixth Street Site. The *Task 3 Report* provides more detailed description of existing conditions at the sites.

Species Surveys and Records

A number of regional wildlife surveys of the lower Los Angeles River vicinity have been conducted in recent years, or are ongoing. Data have been collected that is relevant to both study areas, and are presented here. Table 2-6 summarizes recent wildlife surveys pertinent to the lower Los Angeles River area.

CH2M HILL has provided an extensive review of existing and historical records of species occurrence in the regional vicinity of the project sites; this review is provided in the *Task 3 Report*. Some summary tables are provided here from that review, including Table 2-7, which provides a summary of historical or current reptile, amphibian, and fish species on the lower Los Angeles River, and their current status on the River. Table 2-8 provides a summary of butterfly species with regional occurrence near the project sites with habitat requirements. This table is useful in designing habitat restoration which may support important and regionally rare species.

TABLE 2-6
Regional Biological Surveys, Lower Los Angeles River

Survey	Source	Comments
Breeding Bird Atlas Project	Natural History Museum of Los Angeles County	Preliminary data for Long Beach Blocks 1 – 5: 57 species recorded as observed, probable, or confirmed breeders
Shorebird Surveys, Lower Los Angeles River	Cooper, 2000; Garrett, 1993	Over 5,500 individuals of 17 species of shorebirds recorded utilizing channel in August, 1999 surveys; spring surveys have fewer numbers
General biological surveys for *Biota of the Los Angeles River*	Garrett, 1993	Summary of museum records and other field surveys for freshwater molluscs, birds, mammals, fish, plants, amphibians, and reptiles on the lower Los Angeles River
Amateur bird surveys	Henry Spreadbury	1985 to 1999 amateur bird surveys from the Dominguez Gap Spreading Ground East Basin to the Los Angeles River; also, Willow Street, Anaheim Boulevard, or Ocean Street

TABLE 2-7
Reptile, Amphibian, and Fish Species on the Lower Los Angeles River Basin[1]

Species	General Habitat	Status On Lower River[2]
Amphibians and Reptiles:		
Pacific slender salamander *Batrachoseps pacificus*	Riparian or other woodlands; damp leaf litter	◑
California newt *Taricha torosa*	Ponds, slow to fast moving water; adjacent uplands	○
Western toad *Bufo boreas*	Soft bottom reaches, temporal or permanent pools; within the channel	●
Arroyo toad *Bufo microscaphus*	Alluvial terraces, riparian woodland, intermittent streams	○
Western spadefoot *Scaphiopus hammondii*	Vernal or temporal pools, grasslands	○
Pacific tree frog *Hyla regilla*	Temporal or permanent pools; within the channel	●
California tree frog *Hyla cadaverina*	Temporal or permanent pools	○
Northern leopard frog[3] *Rana pipiens*	Introduced; ponds, canals, streams	●
Red-legged frog *Rana aurora*	Pools, quiet streams, emergent and riparian vegetation	○

TABLE 2-7
Reptile, Amphibian, and Fish Species on the Lower Los Angeles River Basin[1]

Species	General Habitat	Status On Lower River[2]
Woodhouse's toad[3] *Bufo woodhousii*	Introduced; uplands, ponds, rivers, marshes	●
Bullfrog[3] *Rana catesbeiana*	Permanent pools; introduced; within the channel	●
African clawed frog[3] *Xenopus laevis*	Permanent water; within the channel	●
Snapping turtle[3] *Chelydra serpentina*	Marshes, ponds, slow moving rivers with aquatic plants	●
Western pond turtle *Clemmys marmorata*	Deep, slow moving waters, wetlands, ponds; riparian woodlands	○
Spiny softshell[3] *Trionyx spiniferus*	Slow moving waters, ponds	●
Red-eared slider[3] *Pseudemas scripta elegans*	Thoroughly aquatic in ponds, marshes; introduced; within the channel	●
California legless lizard *Anniella pulchra*	Riparian woodlands with soft soil	◑
Coast horned lizard *Phrynosoma coronatum*	Loose sandy soils and washes, scrub or woodland; forages on harvester ants	◑
Western whiptail *Cnemidophorus tigris*	Dry habitats with open, sparse cover	◑
Western fence lizard *Sceloporus occidentalis*	Dry open uplands	●
Southern alligator lizard *Gerrhonotus multicarinatus*	Dry open uplands	●
Western rattlesnake *Crotalus viridis*	Various habitats, including coastal dunes, woodlands, scrub, grasslands	◑
Common kingsnake *Lampropeltis getulus*	Upland, woodland, coastal marshes, various habitats	◑
Common garter snake *Thamnophic sirtalis*	Various upland or wetlands	●
Two-striped garter snake *Thamnophis hammondii*	Found in or near permanent water, with willows or other dense riparian vegetation; within the channel	◑
Ringneck snake *Diadophus punctatus*	Moist woodlands, forest, grasslands, gardens	◑
Inland Fish:		
Pacific lamprey *Lampetra tridentata*	Anadromous; spawned in main river and larger tributaries	○
Southern steelhead *Oncorhynchus mykiss*	Anadromous; spawn in main river and larger tributaries	○
Pacific brook lamprey *Lampetra pacifica*	Lowland streams, springs, river, and marsh	○
Arroyo chub *Gila orcutti*	Lowland streams, springs, river, and marsh	◑ (down to Sepulveda Basin)
Unarmored threespine stickleback *Gasterosteus aculeatus williamsoni*	Lowland streams, springs, river, and marsh	○

TABLE 2-7
Reptile, Amphibian, and Fish Species on the Lower Los Angeles River Basin[1]

Species	General Habitat	Status On Lower River[2]
Santa Ana sucker *Catostomus santaanae*	Foothills but also in main river channel in lowlands	○

Notes:
1- Sources:
Swift and Seigel, 1993
Bezy et al., 1993
Jennings and Hayes, 1994
CH2M HILL, 2001b

2- Key:

● Extant on lower river

◑ Extant in isolated occurrences or scattered distribution on lower river

○ Extirpated on lower river

3- Introduced species

TABLE 2-8
Butterfly Species of Regional Interest and Concern

Species	Status	Habitat
Acmon Blue *Plebeius acmon*		Desert, fields, prairie hills, weedy areas, road edges
American Lady *Vanessa virginiensis*	SI	Gnaphalium
Anise Swallowtail *Papilio zelicaon*		Bare hills, mountains, gardens, fields, vacant lots, and roadsides
Brown Elfin *Callophrys augustinus*	SI	Dodder; very rare on Palos Verdes
Cabbage White *Pieris rapae*		Open space including weedy areas, gardens, roadsides, cities, and suburbs
California Ringlet *Coenonympha california*	SI	Native bunch grasses; no longer found on Palos Verdes Peninsula
Chalcedon Checkerspot *Euphydryas phaeton*	SI	Monkeyflower; no longer found on PV Peninsula
Checkered White *Pontia protodice*	SI	Native mustards; a declining species in the basin
Cloudless Sulfur *Phoebis sennae*		Disturbed open areas including parks, yards, gardens, beaches, road edges, abandoned fields, scrub
Common Buckeye *Junonia coenia*	SI	*Plantago* sp.
Common Checkered-Skipper *Pyrgus communis*		Mallows

TABLE 2-8
Butterfly Species of Regional Interest and Concern

Species	Status	Habitat
El Segundo Blue Butterfly *Euphilotes battoides allyni*	FE	Restricted to a single host plant, Dune Buckwheat *(Eriogonum parviflorum)*
Eufala Skipper *Lerodea eufala*	SI	Grasses; declining in LA basin
Fatal Metalmark *Calephelis nemesis*	SI	Mulefat
Fiery Skipper *Hylephila phyleus*		Grasses
Funereal Duskywing *Erynnis funeralis*		Deserts, warm or arid lowlands, roadsides
Gray Hairstreak *Strymon melinus*		Open, nonforested sites; common in disturbed, weedy areas
Green Hairstreak *Callophrys dumetorum*		Coastal hills and dunes, rarely chaparral
Gulf Fritillary *Agraulis vanillae*		Pastures, open fields, second-growth subtropical forest and edges, city gardens
Henne's Eucosman Moth *Eucosma hennei*	FSC	Endemic to the El Segundo dunes. Larvae dependent on foodplant, branching phacelia (*phacelia ramosissima* var. *austrolitoralis*)
Lorquin's Admiral *Limenitis lorquini*	SI	Willow riparian; now a very rare visitor to region
Marine Blue *Leptotes marina*		Open areas including mesquite scrub, city gardens, desert, alfalfa fields, and waste areas
Monarch *Danaus plexippus*		Open habitats including fields, meadows, weedy areas, marshes, and roadsides
Mourning Cloak *Nymphalis antiopa*	SI	Willows
Northern White-Skipper *Heliopetes ericetorum*		Open woodland, chaparral, dry washes, desert mountains, arid land
Orange Sulfur *Colias eurytheme*		Open areas, especially clover and alfalfa fields, mowed fields, vacant lots, meadows, road edges
Painted Lady *Vanessa cardui*	SI	Thistles
Palos Verdes Blue Butterfly *Glaucopsyche lygdamus palosverdesensis*	FE	Restricted to a single host plant, Southern California locoweed (*Astragalus trichopodes* var. *lonchus*)
Purplish Copper *Lycaena helloides*	SI	Dock and riparian; no longer found on Palos Verdes Peninsula
Queen *Danaus gilippus*		Open, sunny areas including fields, deserts, roadsides, pastures, dunes, washes, and waterways
Reakirt's Blue *Hemiargus isola*		Grasslands, fields, desert, meadows, weedy areas, creeksides

TABLE 2-8
Butterfly Species of Regional Interest and Concern

Species	Status	Habitat
Red Admiral *Vanessa atalanta*	SI	Nettle
Sachem *Atalopedes campestris*		Grasses
Sandhill Skipper *Polites sabuleti*		Saltgrasses
Sara Orangetip *Anthocharis sara*		Open meadows and the edges of wooded areas.
Stella Orangetip *Anthocharis stella*	SI	Deserts, open woods, orchards, fields, meadows, stream courses, canyons
Sleepy Orange *Eurema nicippe*		Low elevation areas including pine flats, fields, desert scrub, gardens, vacant lots, road edges, and washes
Spring Azure *Celastrina ladon*		Forest edges and openings, old fields, marshes, swamps, roadsides, and where flowering shrubs are abundant.
Square-Dotted Blue (*Euphilotes bernardino ssp. bernardino*)	SI	Eriogonum fasciculatum
Sylvan Hairstreak *Satyrium sylvinus*	SI	Willow riparian; no longer found on Palos Verdes Peninsula
Umber Skipper *Poanes melane*		Grasses, sedges
Wandering Skipper *Panoquina errans*	CSC	Saltgrass; generally coastal marshes, dunes
West Coast Lady *Vanessa annabella*	SI	Mallows, cheeseweed especially
Western Pygmy-Blue *Brephidium exile*	SI	*Atriplex* sp.
Western Tailed-blue *Everes amyntula*	SI	Open areas with low shrubs including chaparral, meadows, and open woodland
Western Tiger Swallowtail *Papilio rutulus*	SI	Willow, cottonwood
Woodland Skipper *Ochlodes sylvanoides*		Grassy areas in chaparral, sagebrush, woodland, gardens, and small streams

Source: Jess Morton, unpublished data; USGS, 2001
Notes:
SI – Species of Interest to the DeForest and Sixth Street Projects
CSC – California Species of Special Concern
FE – Federally listed as Endangered
FSC – Federal Species of Special Concern

2.2.3 Target Vegetative Communities

Based on the general location of the subject sites, the occurrence of historic plant communities in these areas, and the general site conditions, it is anticipated that any on-site restoration efforts will be limited to a relatively small number of plant communities. These may include riparian woodland and scrub, herbaceous emergent or seasonal wetland, salt/brackish marsh, and dune scrub and grassland associations. While creation of additional communities may be possible on the sites, it is likely that one or more of these associations represented historical conditions. Target conditions for these general community types, and species-specific requirements, are briefly presented in the following subsections. More detail on the opportunities and constraints for plant community creation on the subject sites is provided in later subsections of this report addressing the specific sites.

River Riparian Forest and Scrub

It is anticipated that communities on both sites supporting riparian woodland and scrub could be established. This community could be developed as a mosaic of open scrub dominated by mulefat with more dense woodland communities dominated by willows, Fremont cottonwood, Mexican elderberry, mulefat, and other tree and shrub species. This plant community would require permanent and/or seasonal water and a high groundwater table, depending on the specific species targeted. Most willows would require perennial water at least a portion if not all of the year, and a generally high groundwater table. Fremont cottonwood also requires a relatively high groundwater table, and is injured by sustained drought. The species-specific requirements for plants in this community are presented in the *Task 3 Report*. More drought tolerant tree species, including California black walnut, Western sycamore, and coast live oak were removed from the final plant palette for this project, at the request of the TAC, since there is no evidence they historically occurred on lowlands in the lower Los Angeles River Basin.

Freshwater Emergent Wetland

This community may be developed on the sites where permanent water or seasonal inundation occurs. Generally, the robust emergent marsh (e.g. bulrush) species may be limited to permanent surface water; in areas with only seasonal inundation or soil saturation, species such as tall flatsedge, sedge, and other species can be established. The *Task 3 Report* provides species-specific requirements for plants in marsh communities.

Salt/Brackish Marsh

Development of this community, if possible, would be restricted to the Sixth Street Site. This community would be limited to areas of tidal inundation, generally between 1.28 and 3.11 meters (4.2 and 10.2 feet) or more above mean low low water (MLLW), and in brackish (mixohaline, salinities 0.5 to 30 ppt) to salt water (polyhaline, salinities 18 to 30 ppt). The *Task 3 Report* provides species-specific requirements for plants in salt/brackish marsh communities.

Native Scrub

This community, or some variant of back dune scrub composed of native scrub species adapted to sandy or alluvial conditions, may be established on either site where conditions

are suitable, including fine, sandy soils. The *Task 3 Report* provides more information on plants in this community. While back dune scrub almost certainly did not occur as far inland as the DeForest Site, a similar alluvial scrub may have been present with some of the same species; this would have developed in disturbance-prone conditions with sandy alluvial soils.

2.2.4 Target Wildlife Communities

The plant communities described above will provide important wildlife habitat for regionally declining or imperiled wildlife species. The habitat conditions and special habitat features that are especially important for wildlife are described below.

Special Habitat Features and Characteristics

Riparian Woodland: Dense willow scrub and riparian tree canopy will help in attracting a number of breeding species, including yellow-breasted chat, yellow warbler (*Dendroica petechia*), downy woodpecker (*Picoides pubescens*), green heron (*Butorides virescens*), and black-crowned night-heron (*Nycticorax nycticorax*). Downy woodpeckers are frequently recorded nesting in cavities in medium- to large-sized willows. Dense riparian scrub adjacent to watercourses is also important for the two-striped garter snake (*Thamnophis hammondii*) and the southwestern pond turtle (*Clemmys marmorata pallida*), and provides shading to watercourses which is important for fish such as arroyo chub (*Gila orcutti*).

Mulefat Scrub: Alone or in combination with willows, this community can attract breeding American goldfinch (*Carduelis tristis*), blue grosbeak (*Guiraca caerulea*), and Anna's, Allen's, and black-chinned hummingbirds (*Calypte anna, Selasphorus sasin, Archilochus alexandri*). Mulefat may also attract butterflies of interest, including fatal metalmark (*Calephelis nemesis*).

Emergent Wetland/Open Water: These habitat components in proximity may attract the following breeding birds: least bittern (*Ixobrychus exilis*), common yellowthroat (*Geothlypis trichas*), tricolored blackbird (*Agelaius tricolo*r), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), pied-billed grebe (*Podilymbus podiceps*), marsh wren (*Cistothorus* palustris), common moorhen (*Gallinula chloropus*), American coot (*Fulica americana*), and cinnamon teal (*Anas cyanoptera*). Virginia rails (*Rallus limicola*) may also nest in dense emergent vegetation.

Open Water: Areas of open water as small as 0.4 hectares (1 acre) will attract ruddy duck, and other resting and foraging waterfowl such as western grebe (*Aechmophorus occidentalis*), gadwall (*A. strepera*), and American wigeon (*A. americana*).

Flowing Water: Flowing water may provide habitat for some fish species, such as arroyo chub, and flowing water will pools deeper than 0.6 meter (2 feet) would provide habitat for southwestern pond turtle.

Mudflats/Shoreline: Mudflats and shore areas will attract foraging shorebirds, including marbled godwit, willet (*Catoptrophorus semipalmatus*), whimbrel, American avocet (*Recurvirostra americana*), and least and western sandpipers.

Tall Trees: Tall native trees, including willows, sycamore, and cottonwoods, provide nest and perch sites for Cooper's hawk (*Accipiter cooperii*) and red-shouldered hawk (*Buteo lineatus*), and a dense overstory is important for species like black-headed grosbeak

(*Pheucticus melanocephalus*), warbling vireo (*Vireo gilvus*), northern oriole (*Icterus galbula*), and Swainson's thrush, all species with some, if limited, potential to colonize the DeForest Site.

Mast Producing Trees: Mast producing trees, such as California walnut or oaks, support some species of wildlife, including western gray squirrel (*Sciurus griseus*). However, it is not clear to what extent some mast producing trees occurred in the lowlands of the lower Los Angeles River Basin.

Barren Islands: Low islands that have little or no vegetation and that are adequately protected from high water in spring will attract breeding killdeer (*Charadrius vociferus*), American avocet, and black-necked stilt.

Forested Islands: Islands with tall trees and dense woodland may attract nesting or roosting ardeids (herons, egrets).

Nest Boxes/Snags: Nest boxes and snags can attract cavity nesting species including tree swallows (*Tachycineta bicolor*), western bluebirds (*Sialia mexicana*), house wrens (*Troglodytes aedon*), barn owls (*Tyto alba*), great-horned owl (*Bubo virginianus*), and ash-throated flycatchers (*Myiarchus cinerascens*). Some species of bats may also roost in tree cavities or crevices.

Basking Sites: Basking sites consisting of logs, clumps of vegetation, or small islands are important for southwestern pond turtle.

Native Plants: A number of native grasses, herbs, and shrubs are important larval host plants for butterflies. This vegetation includes mallows, mulefat, native mustards, monkeyflower, native bunch grasses, *Plantago* sp., stinging nettle, saltgrass, *Atriplex* sp., curly dock, California buckwheat, and willow and cottonwood.

Loose or Sandy Soils: Loose but firm soils are important for fossorial mammals, such as California ground squirrel (*Spermophilus beecheyi*), and sandy soils may support coast horned lizard (*Phrynosoma coronatum*) or California legless lizard (*Anniella pulchra*).

Wildlife Indicator Species

Indicator species represent species that are likely to colonize a site when key habitat criteria are met, or are otherwise sensitive to site conditions in such a way that the species presence on a site provides an indication of the type and quality of habitat present. By recognizing key indicator species for the proposed habitat conditions, colonization of the habitat by the indicator species can represent success in implementing habitat goals. Table 2-9 provides indicator species for proposed site habitats and key habitat conditions. Most of the species indicated are sensitive fauna that would not colonize the site until a certain level of habitat quality was achieved, and in some cases would not colonize the proposed project sites at all, but may colonize more extensive restoration sites in the region.

TABLE 2-9
Indicator Species for Habitat Quality, Lower Los Angeles River Region

Habitat	Indicator Species	Activity	Conditions Indicated	Potential in Restored Habitat-Lower River
Aquatic/Riverine	Southwestern pond turtle *Clemmys marmorata pallida*	Forage/ Basking	Good aquatic habitat structure, water quality, adjacent uplands, lack of exotics	Low
	Arroyo chub *Gila orcutti*	Spawn	Clear, flowing water, ample spawning substrate, few exotics	Moderate
	American avocet *Recurvirostra americana*	Breed	Bare islands surrounded by water	High
Salt/Brackish Marsh	Belding's savannah sparrow *Passerculus sandwichensis beldingi*	Breed	Extensive marsh, intact hydrology and habitat	Low
	Wandering Skipper *Panoquina errans*	Breed	Saltgrass; intact salt marsh habitat	Moderate
Fresh Emergent Marsh	Western least bittern *Ixobrychus exilis hesperis*	Nesting rookery	Tall, extensive stands of emergent vegetation mixed with open water and clumps of woody vegetation	Moderate
	Tricolored blackbird *Agelaius tricolor*	Nesting colony	Extensive marsh and open water	Moderate
	Common moorhen *Gallinula chloropus*	Nesting	Dense emergent growth with open water	High
	Ruddy duck *Oxyura jamaicensis*	Roosting/ Foraging	Open water greater than 1 acre	High
River Riparian	Yellow-breasted chat *Icterus virens*	Nesting	Dense shrub growth	High
	Least Bell's vireo *Vireo bellii pusillus*	Nesting	Extensive, dense, multi-storied canopy	Low
	Yellow warbler *Dendroica petechia*	Nesting	Well developed riparian canopy	High
	Swainson's thrush *Catharus ustulatus*	Nesting	Tall trees and well-developed riparian canopy	Moderate
Alluvial Terrace Open Woodland	Southwest arroyo toad *Bufo microscaphus californicus*	Forage; aestivation	Lack of exotic species; natural hydrology	None
	Coast horned lizard *Phrynosoma coronatum*	Forage	Intact invertebrate fauna (harvester ants)	Moderate

TABLE 2-9
Indicator Species for Habitat Quality, Lower Los Angeles River Region

Habitat	Indicator Species	Activity	Conditions Indicated	Potential in Restored Habitat-Lower River
Vernal Pool Grassland	Western spadefoot *Scaphiopus hammondii*	Breeding; aestivation	Natural hydrology; lack of exotics; intact habitat	Low
Perennial Grassland	Burrowing owl *Athene cunicularia*	Breeding; wintering	Extensive intact habitat	Low
	California ringlet *Coenonympha california*	Breeding	Native bunch grasses	Low
Sand Dune Scrub	El Segundo Blue Butterfly *Euphilotes battoides allyni*	Breeding	Host plant (dune buckwheat) in intact habitat	Low
	Palos Verdes Blue Butterfly *Glaucopsyche lygdamus palosverdesensis*	Breeding	Host plant (Southern California locoweed)	Low
	Pacific Pocket Mouse *Perognathus longimembris pacificus*	Resident	Sandy coastal soils	Low
Coastal Sage Scrub	California gnatcatcher *Polioptila californica*	Breeding	Intact, extensive habitat	Low

2.2.5 Existing Restoration Projects

A number of other efforts that involve wetland or native habitat restoration are underway in the lower Los Angeles River watershed. This includes land set aside for habitat preservation and active efforts to restore habitats. These efforts are in varying stages of implementation, and understanding these projects may be of use during concept-level planning for the DeForest Park and Sixth Street Sites. Nearby restoration/preservation efforts may function as reference sites, providing information as to feasibility and effectiveness of habitat improvement/protection on the subject sites. Understanding the proximity of restoration sites to the subject sites may also provide a regional picture of the connectedness (or lack of) of native habitats, a factor that may be important for some wildlife species, and will be useful in documenting the scarcity of, and high value associated with, restoration of riparian and wetland habitats. Locations of regional preserves and restoration sites is provided in Figure 2-1. A more complete description of these sites is provided in the *Task 3 Report.*

2.3 DeForest Site Conditions and Constraints

2.3.1 Site Overview

The DeForest Site is a long, linear parcel encompassing approximately 15 hectares (38 acres) along the Los Angeles River in the City of Long Beach (Figure 1-2). It lies on a north-south axis, extending about 2,010 meters (6,600 feet) between the developed DeForest Park to the

north and Del Amo Boulevard to the south. The site is approximately 90 meters (300) feet wide, and is bordered on the west side by the Los Angeles River levee, which effectively isolates the site from the river. The site elevation ranges from 7 to 15 meters (25 to 50 feet) msl (NGVD-29). The levee is about 7.6 meters (25 feet) above the river channel in this location, and is topped by the regional mountains to ocean LARIO bicycle trail. The river itself is lined with concrete along this reach; the low-flow channel has water year-round, supplied by discharge from two upstream water treatment plants. East of the DeForest Site are residential neighborhoods, including a trailer park and an elementary school.

The DeForest Site North Basin and the South and Central Basins are not separated hydrologically, and in general water flows from the North Basin to the Central and South Basins. The North Basin is the location of the DeForest Park Nature Center, which consists of an extensive area of planted woodland, dense in some locations, and a well-used nature trail. The planted woodland is a mix of native and non-native species. Two storm drains, operated by LACDPW, are located at the north end of the North Basin, and discharge enough year-round water to support an emergent wetland that runs the length of the North Basin. Just to the north of the Nature Center is the developed DeForest Park, which consists of active sports fields and landscaped park areas.

The Central and South Basins consists of more open and ruderal land cover, with only scattered trees and shrubs. Some native vegetation is present, as well as stands of non-native ornamental trees planted on the perimeter of the basin adjacent to residential areas. A storm drain outlet and the Market Street Pump Station are present between the Central and South Basins and are operated by LACDPW. The pump station is at the low point in the Central and South Basins and water flows to it from both the south and north ends of the basin, as well as from the storm drain, before being pumped out to the Los Angeles River. The entire DeForest Site is used by the LACDPW as a holding basin for flood detention for stormwater runoff from adjacent residential neighborhoods.

South of the DeForest Site, just south of Del Amo Boulevard, is the East Basin of the Dominguez Gap Spreading Grounds, operated by the LACDPW. Low-flow runoff from the Los Angeles River is currently diverted to the East Basin for storage and groundwater recharge purposes; the basin also receives local uncontrolled stormwater runoff. Overflow from the East Basin is either pumped to the Los Angeles River by the Dominguez Gap Pump Station, or retained and ultimately diverted through a 41-inch siphon to the West Basin of Dominguez Gap Spreading Grounds on the west side of the Los Angeles River for groundwater recharge.

2.3.2 Physical Features

Topography

The long linear DeForest Site generally consists of a central low channel invert running the length of the site, with moderate to steep slopes running up both sides of the site; on the west side this slope ties into the Los Angeles River levee slope, on the east it levels off into residential neighborhoods. The elevation change in the DeForest Site between the channel invert and the top of the levee ranges from 7.9 to 11.3 meters (26 to 37 feet). The elevation change between the top of the basin on the east side of the basin and the invert ranges from 4.6 to 9.1 meters (15 to 30 feet). The range of elevations (given in NGVD-29) in the channel

invert in the DeForest Site are from 10.1 meters (33.0 feet) msl at the north of the site to 7.8 meters (25.6 feet) msl at the Market Street Pump Station. The river elevation at the bottom of the channel adjacent to the base of the levee is 11.3 meters (37.0 feet) msl at the north end of DeForest Site, and 8.2 meters (27.0 feet) msl at the south end of DeForest Site, for a total drop in the river channel elevation over the length of the site of just over 3.0 meters (10 feet).

Water flow on the site proceeds in a southerly direction north of the Market Street Pump Station, flowing from the storm drains at the north end of the site to the pump station. The total elevation change from the north end of the site to the pump station along this axis is 1.55 meters (5.1 feet). South of the pump station, from Del Amo Boulevard north to the pump station, water flows in a northerly direction. Water is pumped into the river from the pump station. The total elevation change from the south end of the site to the pump station is 0.98 meters (3.2 feet).

The lateral and longitudinal grades of the DeForest Site as they currently exist would necessitate some basin regrading to maximize use of stormwater flows from existing locations or from the Los Angeles River low flow channel. Current longitudinal grade is gentle and would limit designs emphasizing rapidly flowing water, such as riffle and run, without re-engineering the overall gradient. Existing south basin topography directs flow from both Long Beach Boulevard on the north and Del Amo Boulevard on the south toward the Market Street Pump Station. The pump station is the low point of the basin and if it is to remain so, then wetland development south of that point will only be possible if water is supplied from the south. Re-engineering of this topography could potentially be accomplished if a hydrologic connection is re-established with the Dominguez Gap Basins and the DeForest Site's flood storage capacity is maintained.

Soils

Based on information from Dominguez Gap Spreading Grounds data, Soils in the DeForest Site area are comprised of stratified medium- to fine-grained sands, silts and silty sands to a depth of 3.0 meters (10 feet) bgs overlying clays to a depth of approximately 9.1 to 10.7 meters (30 to 35 feet) bgs (WRD, 2001a). Medium- to coarse-grained sands exist below 10.7 meters (35 feet) bgs. These data are representative of southern portions of the DeForest Site. Surface soils are comprised of graded native and fill material brought into the basin during development.

Water recharge studies conducted in the Dominguez Gap Spreading Grounds East Basin (south of Del Amo Boulevard), indicate that water recharge or infiltration rates can be as high as 0.114 meters per day (0.375 feet per day), which are representative values for medium- to fine-grained sands and silty soils. The soils in the vicinity were reported to be suitable for groundwater recharge (WRD, 2001a; Komex, 2001).

While infiltration rates are relatively high, wetlands in general show good sealing over time once hydrated, and no constraints are anticipated to wetland development from soil conditions.

2.3.3 Utilities and Infrastructure

There are a number of utilities and infrastructure in the vicinity of the DeForest Site. Information regarding utilities that are in the area of the DeForest Site was obtained from the Underground Service Alert (Digalert), and are provided in the *Task 3 Report*. Utilities include gas, petroleum, sewer, and water lines, and various cables. In addition, there are four storm drains that discharge into the DeForest Basin. Additional infrastructure that exists at the project site includes the Los Angeles River levee, fencing, the Long Beach Boulevard Crossing, and the Market Street Pump Station. The Los Angeles River Levee also runs the length of the DeForest Site.

There are several utility and infrastructure elements at the DeForest Site that could constrain development or would require modification to allow site improvement. These include: the existing basin maintenance roadway that crosses the south basin, located south of Long Beach Boulevard; the sealed culvert connecting the DeForest Site with the Dominguez Basin East Basin; an exposed sewer line that crosses the south basin upstream of the Market Street Pump Station; and other buried utilities that could interfere with basin grading.

2.3.4 Water Supply

Four water sources were considered for use in restoring the DeForest Site: stormwater runoff, Los Angels River water, recycled water, and Interstate 105 water. These sources, including pros and cons of each, are provided in Table 2-10.

TABLE 2-10
Potential Water Supply Sources for DeForest Site

Water Supply Source	Description	Pros	Cons
Stormwater Runoff	Stormwater flow from the surrounding watershed, which is currently detained in the basin for flood control. The design flow for the DeForest Basin is 1,526 cfs.	No restrictions on use; quality could be enhanced	Limited quantity and seasonally limited
Los Angeles River Water	River water diverted for the Los Angeles River into the basin. There is approximately 160 cfs of flow at the project site.	Large quantity and not limited seasonally; quality could be enhanced	Requires pipeline to supply and may be limited by water rights; low quality
Recycled Water	Tertiary treated wastewater from the Long Beach Water Reclamation Plant.	Good quality	Quantity available for project would be limited; City would not choose to use this source; no infrastructure for delivery is available
I-105 Water	Groundwater pumped from the Central groundwater basin and treated by Caltrans. The groundwater production rate is approximately 2000 afy.	Large quantity; good quality	Must be piped to site; may be infiltration requirements

Stormwater runoff currently enters the site from a series of storm drains and supports a well-established emergent marsh in the north basin. A possible additional source of

stormwater runoff exists at the City's Basin 15, north of the DeForest Site. This basin currently collects stormwater runoff and nuisance flows and discharges them to the Los Angeles River via the North Boundary Pump Station at Artesia Boulevard. The possibility may exist to reroute flows from the North Boundary Pump Station to the DeForest Site. The development of a wetland system at the site would also serve to improve stormwater quality and allow for its potential reuse if excess flows were available.

The adjacent water of the Los Angeles River is a possible additional source. Use of this water would require securing the approval of LACDPW and USACE and constructing an intake structure. Water rights would also need to be secured and it is presently unclear if that right rests with LACDPW for diversion at Dominguez Gap East Basin or with Los Angeles Department of Water and Power under pueblo rights or as the discharger of treated wastewater effluent. The future long-term availability of water from the Los Angeles River is also at question. Approximately 80 percent of the flow is wastewater effluent and programs to increase reuse may over time reduce river flows.

Recycled water was not seriously considered, as there is no direct infrastructure for delivery to the site. Lines are in the vicinity; however, the City is interested at this time in the potential to improve water quality and reuse any extra flow recover from the site for irrigation at DeForest or adjacent areas.

Interstate 105 water is a good source of treated groundwater. This water could be used to augment stormwater runoff for wetland development on site. If the hydrologic conductivity is restored between the DeForest Site and the Dominguez Gap East Basin, the water could be used for restoration at DeForest and allowed to flow through for restoration purposes and/or recharge at the Dominguez Gap Basins. Cost considerations must be given to the following: (1) use of the water, (2) transport and delivery of the water to the DeForest Site, and (3) re-establishing the link between the DeForest and Dominguez Gap Basins before it can be determined to be a viable water source.

2.3.5 Basin Operations

The DeForest Site is operated by LACDPW for flood control and stormwater retention. The basin is approximately 2,010 meters (6,600 feet) long and 90 meters (300 feet) wide with a storage volume of approximately 185 acre-feet at a control elevation of 38.0 feet (LACDPW, 2000). There is no dead storage in the basin; therefore, any changes to the configuration of the basin will be designed so that the storage capacity is not affected. The only water supply source for the basin originates from storm drain runoff and/or direct precipitation. Currently, the basin is used to temporarily retain stormwater before discharge to the Los Angeles River.

There are three storm drains and two local drain that enter the DeForest Site. The Harding Street SD, SD 129, as well as two local drains enter the basin in the DeForest Site North Basin in the existing DeForest Nature Trail area, including a 30-inch local drainage pipe that collects and transports flow from the baseball fields and park to the north into the DeForest Nature Trail, and another local drain near Cedar Street. In the Central Basin, the Market Street SD is a 15-foot by 11-foot box culvert that enters the DeForest Site at Market Street.

The Market Street Pump Station is part of the SD 129 and Market Street drainage system; it has four pumps and a total pumping capacity of 360 cfs with each pump being capable of discharging 40,400 gallons per minute (gpm) or 90 cfs. The pump well for the pump station is at an elevation of 5.5 meters (18 feet) msl. The pumps start to operate at 28.0, 29.0, 30.0, and 31.0 feet msl. The maximum design water level for the basin is 38.0 feet msl. The pump floor has an elevation of 46.0 feet and the top of the surrounding levee is at about 50 feet.

In general, wetland designs are anticipated to increase flood storage capacity. LACDPW has indicated that a new site hydrology study is needed to better identify what portions and areas of the basin are actually required. It is recommended that the City and Coastal Conservancy coordinate with LACDPW for the completion of this Study. Once completed, or if completed in conjunction with further City and Coastal Conservancy design for the DeForest Site, better data will be available on what flood-storage capacity must be maintained to protect adjacent residences.

2.3.6 Biological Resources

Plant communities on the site include the extensive exotic species woodland located in the DeForest Site North Basin. This community was originally planted in the 1970s, and has developed into a dense, closed canopy forest with relatively little understory. Species include Chinese elm, Shamel ash, blue gum, American sweetgum, California pepper tree, Brazilian pepper tree, and others. Some native trees are planted in with the exotic woodland, or have established on other parts of the site. This includes Western sycamore and Fremont cottonwood. In the wetter portions of the North Basin along the perennial flow from the storm drains, a well-developed riparian canopy of Goodding's willow and sandbar willow has been established, along with dense emergent plant growth in areas of greater inundation; species include common tule (*Scirpus acutus*) and California bulrush (*S. californicus*). In areas of seasonal or less frequent inundation, species include curly dock (*Rumex crispus*), tall flatsedge, common plantain (*Plantago major*), and Bermuda grass (*Cynodon dactylon*). Goodding's willow and other willow species are found scattered throughout the wetland area. The total area of the wetland is 0.96 hectares (2.38 Acres).

On the DeForest Site Central and South Basin, conditions are drier than on the North Basin, and year-round flow is limited to the short distance between the storm drain outlet and the pump station inlet, located in the center of the basin. Some emergent growth occurs surrounding these structures, but otherwise the basin consists exclusively of upland vegetation. It is predominantly ruderal, non-native species, dominated by shortpod mustard (*Hirschfeldia incana*), Russian thistle (*Salsola tragus*), Canada horseweed (*Conyza canadensis*), castor bean (*Ricinus communis*), and others. Some exotic and native trees are located in scattered locations on the site or on the perimeter of the site. In addition, some perimeter locations, particularly along the Los Angeles River levee, have been planted with native species, including Western sycamore, mulefat, and purple sage.

The opportunity exists to re-establish historic plant communities of the lower Los Angeles River at the DeForest Site. These include river riparian forest scrub and freshwater emergent wetland, both communities that would create important wildlife habitat in the area. The margins of the site could support the upland back dune scrub community (native scrub), though possibly not historically present in this area, nonetheless rare in Southern California and suited to the sandy soils on site. A mosaic of habitats could be created at the

site consisting of up to 38 acres of river riparian forest and emergent wetlands. The potential also exists to include back dune scrub in the mosaic on the upslope portions of the basin or south of the Market Street Pump Station where existing site topography grades to the north preventing water flow.

2.3.7 Recreational/Public Use Resources

Recreational/public use opportunities at the DeForest Site include a variety of passive uses such as viewing of interpretive displays, group or individual picnicking, observation points in the form of platforms or towers, and an interlinked self-guided trail system with designated rest and contemplation points. The major constraints to improved public use are limited parking and public safety in this urbanized site. Design of habitat improvements that allow for a 360 degree line of site (reduce tree cover), or that separate public use from densely vegetated areas, will help to improve public safety at the site. The addition of lights at key locations and increased activity by school groups and other public users will also help to reduce loitering and improve public safety.

The City has indicated they are interested in an Interpretive Center with two classrooms, each sufficient in size to hold 45 elementary school students, and six staff office spaces. Several locations have been identified at, or in the vicinity of, the DeForest Site that could be suitable for the Interpretive Center. These include the DeForest Recreation Center site, DeForest Avenue between South Street and Chestnut Street, southeast of Long Beach Boulevard Bridge, between 51st and 52nd Streets, and a parcel adjacent to Sutter School. Each of these sites could also be used for smaller satellite interpretive facilities such as kiosks, pavilions, or signage displays.

2.3.8 Environmental Records Review

CH2M HILL conducted an Environmental Records Review for the DeForest Site using an American Society for Testing and Materials (ASTM) Electronic Database Report (EDR). The purpose of the records review was to obtain and review records that help identify recognized environmental conditions (RECs) associated with the DeForest Site and adjoining properties. Based on information provided in the EDR report, no RECs were identified at the DeForest Site. However, several properties were identified that might have the potential for environmental impact at the DeForest Site. Sites that are considered to have a potential for environmental impact at the DeForest Site are based on impact to groundwater, ongoing investigation, and their proximity to the DeForest Site.

Two sites with potential for environmental impact are the United Oil Company Station #41 site and the Fire Station #11 site. These sites are approximately 0.34 mile and 0.38 mile southeast and east of the DeForest Site. Both are currently undergoing remediation for groundwater contamination. Because of the proximity of these sites to the DeForest Site, there is potential for the groundwater contamination to have migrated onto the DeForest Site. Due to the proximity of the subject sites to major water features, direction of groundwater flow in the area is variable without known site-specific data. Based on the information provided in the EDR report, agency file review is recommended for the above-identified sites to further assess potential impacts to the DeForest Site.

2.4 Sixth Street Site Conditions and Constraints

2.4.1 Site Overview

The Sixth Street Site is about 1.6 hectares (4 acres) and is located adjacent to the Los Angeles River about 10 kilometers (6 miles) downstream from the DeForest Site, and about 3 kilometers (2 miles) upstream from the River's mouth at the Pacific Ocean (Figure 1-3). It lies just south of the Shoemaker Bridge overpass, where the 710 Freeway empties out onto Shoreline Drive and Sixth Street in Long Beach. As such, it is surrounded on three sides by roadway, including the bridge overpass on the north, and the Sixth Street and Shoreline Drive offramps on the east and south. In addition, a presently unused underpass from Seventh Street, and an unused onramp to Shoreline Drive, are located in the south center of the site. The Los Angeles River Levee lies along the western boundary of the site. The site is about 445 meters (1,100 feet) in length, and about 80 meters (200 feet) wide in the wider middle portion. The top of the levee is on average about 3 meters (10 feet) above the site, with the top of the levee about 6 meters (20 feet) above the mean water level in the river. The river is tidally influenced and brackish at this location, and at sea level.

The Sixth Street Pump Station operated by the City is located in the center of the site; this station delivers stormwater from City streets to the Los Angeles River. Areas surrounding the pump station, and covering a large portion of the site, are disturbed and largely unvegetated. Vegetation does occur in the southern portion of the site, along the Los Angeles River levee, and along the Shoreline Drive offramp. This consists of natural/ semi-natural vegetation, landscaped areas with ornamental trees, and revegetated areas apparently planted with native species. A small wetland area occurs on the south of the site, watered from surface runoff, and supporting a stand of cattail.

Additional land use in the area includes the Cesar E. Chavez City Park to the southeast, a school directly to the east across Shoreline Drive, county bus facility and other light industrial uses to the north. An unused vacant lot lies just north of the Shoemaker Bridge, and is continuous with the DeForest Site under the bridge overpass.

2.4.2 Physical Features

The site generally consists of a central low basin surrounded by the raised Los Angeles River Levee on the west, and raised roadway structures and berms on the other sides; elevation (given in NGVD-29) of the site averages about 3 meters (10 feet) above msl. There is generally no defined drainage channel anywhere on the site. The elevation change in the Sixth Street Site between the average basin elevation and the top of the levee averages about 3 meters (10 feet). Elevations on the east side of the basin increase gradually along the southern portion of the site or dramatically along the northern portion of the site, up to the roadways that surround the site on this side. Los Angeles River elevations adjacent to the site fluctuate with tidal influence, but range from just under msl (mean low low tide) to 1.5 meters (5 feet) above msl. The site gradually loses elevation in a north to south direction, and is about 1.5 meters (5 feet) lower on the south end of the site than the north end.

The site is higher than the adjacent Los Angeles River invert and if tidal connection was desired to create salt marsh or brackish marsh habitat, the site would need to be brought

down from 3 to 6 feet. Side slopes of 2:1 at a minimum would be required to protect surrounding infrastructure. This would limit the area available for restoration.

2.4.3 Utilities and Infrastructure

Extensive infrastructure was identified at the Sixth Street Site. This includes the Los Angeles River Levee, which runs the length of the site on the west. The Shoemaker Bridge, Sixth Street offramp, and I-710 bound the site to the north, east, and south, respectively. In addition, the site has an abandoned roadway, which exists at the southeastern portion of the site. Also, a railroad spur used to run through the site. The Sixth Street Pump Station is located in the central portion of the site next to the Sixth Street offramp, and has subsurface storm drain leading to it and discharge lines leading from it. A utility bridge crosses the Los Angeles River along the western edge of the site, and additional underground utilities are present. Utilities identified during site database searches are described in the *Task 3 Report*; they include petroleum, sewer, water, and gas pipelines, as well as telephone and cable lines.

In development of the Sixth Street Site, there are a number of possible utility conflicts. These include numerous bridge piers, portions of an abandoned road in the site, the Sixth Street Pump Station, and buried utilities. The bridge piers will need to be avoided and a minimum of a 2.5-foot area left at grade as a buffer area. The abandoned road could be removed or may be used as access for the pump station if the northerly access under Shoemaker Bridge is removed as part of restoration. The pump station must remain in place and so it will limit the area available for restoration. The depth to the buried storm drain and other utilities must be verified prior to final design to ensure there is no conflict with restoration plans. Finally, the final restoration plan must take into consideration the need for access to the pump station and to the utility lines that cross the Los Angeles River via a bridge at the south end of the site. It appears that currently this bridge is accessed through the site.

2.4.4 Water Supply

Three water sources were identified for the Sixth Street Site. These include stormwater runoff, Los Angeles River water, and recycled water; a summary of these water sources, including pros and cons, is provided in Table 2-11. The possibility may exist to reroute flows from the 3rd Street gravity outfall and the Seaside Pump Station. Upon receipt of final storm drain system layout from the City, the feasibility of rerouting the local stormwater runoff can be determined. It must also be verified that there is enough capacity in the existing storm drain system at the site to carry the flows needed. There is little to no data available on the stormwater quality and quantity. It is recommended that at least 1 year of data on seasonal quality and quantity be collected to better assess the viability of this water source.

TABLE 2-11
List of Potential Water Supply Sources for Sixth Street Site

Water Supply Source	Description	Pros	Cons
Stormwater Runoff	Stormwater runoff from the City of Long Beach storm drain system, which drains approximately 1,083 acres.	No restrictions on use; quality could be enhanced	Limited quantity and seasonally limited
Los Angeles River Water	The Los Angeles River is tidally influenced at the project site; therefore, no value for flow in the river exists. Tidal information is provided in the *Task 3 Report*.	Quantity unlimited; brackish constitution for tidal marsh creation	Would require tidal connection to site and significant grading to bring site to tidal elevations
Recycled Water	Tertiary treated wastewater from the Long Beach Water Reclamation Plant.	Good quality	Quantity available for project would be limited; City would not choose to use this source

As with the DeForest Site, diversion of Los Angeles River water will require construction of a new intake structure or breach in the levee. The Sixth Street Site is approximately 10 feet above sea level and would require site grading or the pumping of river water to the site. An abandoned outfall pipe exists at the southern end of the site and could be used for discharge of water back to the river. This would be especially useful if water was diverted at an upstream location in adjacent City open space and allowed to flow south to the Sixth Street Site before being diverted back to the river. At this location, the Los Angeles River is under tidal influence and so will be brackish water, influencing the plant species it will support.

Recycled water would require construction of a delivery system. This water source was not looked at in depth at this time due to the City's preference to use other water sources.

2.4.5 Biological Resources

Plant communities on the site are generally limited to landscaped areas, ruderal vegetation present on disturbed sites, areas planted with native species, and two small wetland areas dominated by emergent marsh species. The large central area surrounding the pump station is disturbed and the soil compacted. Only limited ruderal vegetation has established on this area, primarily around the perimeter and along the Los Angeles River levee. Along existing roadways, including the Seventh Street extension and Shoreline Drive, there is non-native landscaping, including eucalyptus, iceplant, alder, palms, pine trees, and other ornamental species. In two locations along the Los Angeles River levee, native species have been planted. One location is along the levee just south of Shoemaker Bridge, which has been planted with Goodding's willow and mulefat; the other is along the levee in the south half of the site, and is planted with western sycamore, Goodding's willow, and mulefat.

Freshwater emergent wetland or salt/brackish marsh could be created at the Sixth Street Site depending on whether the water source is the Los Angeles River or stormwater. Either community would provide a pocket of wildlife habitat that may be augmented by newly acquired City properties or properties in acquisition.

The water balance analysis looked at the estimated existing water balance onsite and one scenario. The scenario looked at the water requirement to sustain a 1.2-acre freshwater emergent wetland. An additional 0.084 cfs of water year round would be necessary to sustain a 1.2-acre freshwater emergent wetland.

If salt/brackish marsh is desired at the site, one of the following would be required: (1) significant grading to lower the site to the Los Angeles River low flow channel elevation, (2) pumping of river water up to the site, or (3) diversion further upstream and flow down through adjoining City open space near the river.

The small size of the Sixth Street Site limits its value and use as wildlife habitat and the potential high cost of water diversion may not be warranted. If this is the case, upland back dune habitat, which is rare in Southern California, and/or a botanical-type garden for nature education, could be established.

2.4.6 Recreational/Public Use Resources

Recreational/public use opportunities at the Sixth Street Site are similar to those at the DeForest Site. Passive in nature, public uses could be combined with habitat improvements so as to minimize interference with wildlife use. Possible amenities include picnicking, a bicycle staging area for connection with the LARIO Trail, placement of observation platforms and interpretive signage, and a small trail for nature observation.

As with the DeForest Site, locations for a City Interpretive Center were identified. Four locations at or near the Sixth Street Site were identified for a two-classroom, six-staff Center. If the Center is not sited at any of these locations, they could serve as satellite facilities with interpretive signage or a kiosk for visitor information.

The Sixth Street Site is a secluded, open-space area in a dense urban and industrial area. As such, development of the site must take in to consideration public safety. As with the DeForest Site, the more actively used by school groups and other public groups, the less attractive the site will be for loiterers.

2.4.7 Environmental Records Review

CH2M HILL conducted an Environmental Records Review for the Sixth Street Site for the City of Long Beach using an ASTM EDR. The purpose of the records review was to obtain and review records that help identify RECs associated with the Sixth Street Site and adjoining properties. Based on information provided in the EDR report, no RECs were identified at the Sixth Street Site. One property was identified that might have the potential for environmental impact at the Sixth Street Site. Sites that are considered to have a potential for environmental impact at the Sixth Street Site are based on impact to groundwater, ongoing investigation, and their proximity to the Sixth Street Site.

One site with potential for environmental impact is the 1X Bulk Terminal Company, Inc. site. This site is located approximately 0.24 mile north of the Sixth Street Site. The groundwater at this site is currently being monitored to characterize the extent of contamination. Because of the proximity to the Sixth Street Site, there is potential for the groundwater contamination to have migrated onto the Sixth Street Site. Due to the proximity of the Sixth Street Site to major water features, direction of groundwater flow in

the area is variable without known site-specific data. Based on the information provided in the EDR report, agency file review is recommended for the above identified sites to further assess potential impacts to the Sixth Street Site. If the Sixth Street Site is to be graded and will intercept the groundwater table, further investigation should be completed to determine if the contamination has affected groundwater at the site.

Figures – Section 2.0

Legend:

▲ Regional Preserves and Restoration Sites

☆ Project Sites

0 19000 38000 Feet

1:228000

CH2MHILL

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Figure 2-1
Locations of Regional Preserves and Restoration Sites

3.0 Conceptual Alternatives and Designs

3.1 Design Considerations

Final design considerations for the site alternatives, as developed from TAC meetings, client coordination, and the public meeting, include the following:

- Early treatment would be developed for the treatment alternative at DeForest Site.
- A mosaic of habitats would be considered along all gradients at DeForest Site, with an emphasis on habitats historically occurring in the area. This may include scrub, dense riparian, wetland, or other native habitats.
- Areas suitable for the large shorebird habitat would be developed, including potential nesting islands, open passage to the adjacent river (e.g. low scrub), and mudflat areas for foraging.
- Small wetland, scrub, and tidal marsh habitat areas may be more effective for attracting and supporting rare species than limited riparian habitat.
- The existing woodland should be enhanced and thinned, and replaced with native species, but the habitat not altogether removed.
- A seawall or crib wall at Sixth Street Site may be effective at the marine interface along the edge of the salt marsh, and would enable additional marsh area.
- Trash collection facilities would be developed at storm drain outlets; however, these outlets are still not likely to be the most optimal entry point to the nature area given aesthetic concerns.
- Areas for wetland development at DeForest Site should be maximized depending on alternatives, but a gradual upland transition should be maintained where possible. As such, grades steeper than 3:1 (3 feet horizontal to 1 foot vertical) would generally be avoided, and lesser grades would be implemented where practical.

3.2 Final DeForest Site Conceptual Designs

3.2.1 Alternative 1

Alternative Summary

This alternative would enhance existing conditions with no water augmentation. The alternative emphasizes eliminating exotic species, enhancing the existing woodland and marsh, and emphasizing riparian plantings as well as dune/alluvial scrub native plantings in the South Basin. Portions of the existing woodland in the North Basin that are predominantly non-native species would be replaced with native woodland species, in general preserving the woodland character of the site but providing thinning and opening

to create less dense woodland. The storm drain outlets would be enhanced with trash removal systems, but no other water treatment would occur. The existing native marsh and riparian habitat would be left intact.

Since no water augmentation is proposed, portions of the site in the South and Central Basins that presently support dry uplands would continue to do so. Non-native vegetation would be removed and the habitat enhanced with native scrub habitat, emphasizing species common to alluvial or dune scrub communities. Native patches of vegetation in the South and Central Basins would be left intact. The Los Angeles River levee adjacent to the site would also be planted with native scrub vegetation. Irrigation would be required to some extent to establish newly planted shrub and woodland vegetation. Recreation development would emphasize enhancing what is already present on the site, with visitor center development at the North Basin.

Physical Development

No site grading is proposed for this alternative; the native grade would be unaltered.

Utilities and Infrastructure

No utility or infrastructure conflicts are anticipated from Alternative 1. Additional infrastructure proposed for installation revolves around the storm drains and trash removal systems. Trash removal in the existing large storm drains, which discharge into the DeForest Site, consists of removal of large debris by trash racks. The existing removal mechanisms should be evaluated for possible rehabilitation or replacement with updated solutions and technology. The conditions could be improved as part of the project by creating easier maintenance access to the trash, providing better screening mechanisms, and adding redundancy to the trash removal system. Table 3-1 provides a list of the potential trash removal mechanisms, which could be employed at the site.

TABLE 3-1
Potential Trash Removal Mechanisms

Mechanism Name	Description	Advantages	Disadvantages
Continuous Deflective Separation (CDS)	Utilizes a vortex of water to trap litter while water escapes through a screen. The system has a bypass weir to allow excess storm flows to bypass system, if necessary.	• Allows bypass of storm flows • Will treat flows from 1 to 300 cfs • Allows end of the pipe treatment • Unit is not mechanical or electrical which reduces maintenance issues • Relatively low head required (0.5 ft)	• Flow with continuous dry weather flow not recommended • Flow must be sub-critical entering unit • Permanent pool of water maintained creating potential vector issues
Inclined Screen	Utilizes a wedge-wire screen placed at a incline in the flow to remove litter.	• Low maintenance cost	• High head required (3 feet) across screen • Potential clogging of screens

TABLE 3-1
Potential Trash Removal Mechanisms

Mechanism Name	Description	Advantages	Disadvantages
Linear Radial	Utilizes a modular and linear ¼ inch x ¼ inch rigid mess screen louvered well casing to remove litter.	• Provides screening during low flow conditions • Low head required • Low maintenance cost	• Space requirements (Length) of unit
Baffle Box	Utilizes a two chamber concept; the first chamber reduces flow velocity, settles out solids, and traps litter by use of an underflow weir. The second chamber uses a bar rack to capture materials that get pass chamber one weir.	• Provides backup for trash removal system through its two chamber system • Low maintenance cost	• Possible odor and vector problem within box due to rotting debris • Potential clogging of device

Water Supply

Stormwater runoff drains from the City and the LACDPW storm drain systems into the DeForest Site; more information on the DeForest Site storm drain system is provided in *Task 3 Report*. The runoff is adequate to support a small wetland on the site (approximately 0.96 hectares [2.38 acres]). Under this Alternative, no changes to the stormwater supply are proposed, and the existing wetland would continue to be supported at the same level it is currently.

Basin Operations

Pump operations of the MSPS would be unaltered under this alternative, and the flood storage capacity of the DeForest Basin would remain unaltered from present conditions.

Biological Resources

Proposed vegetative communities/habitat types for the DeForest Site under Alternative 1 are presented in Figures 3-1a-c. Table 3-2 provides the total acreage of proposed existing and new plant communities by basin. A plant palette for vegetative communities proposed for the DeForest Site is provided in the *Task 5 Report.* More information on plant species requirements and growth forms is provided in the *Task 3 Report.*

Plant communities under this alternative include the existing Low Riparian/Shallow Marsh in the wetter portions of the North Basin along the perennial flow from the storm drains, including a well-developed riparian canopy of Goodding's willow and sandbar willow, along with dense emergent plant growth of bulrush and other wetland plant species. This portion of the basin would be enhanced by removal of existing exotics and ongoing maintenance. Areas currently occupied by non-native woodland species would be replaced with a High Riparian canopy, consisting of native riparian woodland species including Fremont cottonwood, Mexican elderberry, mulefat, and other species. In general, an open woodland canopy would be developed, with dense vegetation restricted to pockets. Native scrub habitat is proposed for the remainder of the site, consistent with what may have occurred in the lower Los Angeles Basin along drier terraces and where blowing sand or alluvial deposition was occurring. Species may include dune buckwheat, California croton, coastal locoweed, goldenbush, and others.

TABLE 3-2
Proposed Acres of Habitat by Basin, DeForest Site Alternative 1

	Acres of Habitat (Intact Existing)[1]			
Zone	**North Basin**	**Central Basin**	**South Basin**	**SITE TOTAL**
High Riparian	6.33 (1.85)	---	0.07 (0.07)	**6.39 (1.91)**
Native Scrub	3.94 (0.76)	7.83	14.02 (0.68)	**25.79 (1.44)**
Shallow Marsh/Low Riparian	2.90 (2.40)	0.07 (0.07)	0.41 (0.41)	**3.38 (2.88)**
BASIN TOTAL	**13.17 (5.01)**	**7.90 (0.07)**	**14.49 (1.15)**	**35.56 (6.23)**

Notes:
1. Portions of existing native habitat would be left intact, with the remainder restored/enhanced; Acres of Habitat includes intact existing plus restored habitat. Existing habitat left intact indicated exclusively in parenthesis.

Recreational/Public Use Resources

Under Alternative 1, public use would be accommodated at a relatively low level but still consistent with the goals of the City in providing opportunities for passive use and elementary education. A relatively small Visitor Center designed for elementary school field trips would be established along DeForest Avenue, somewhat to the south of the existing Nature Center entry, which would be closed off. The Visitor Center would serve as a "gatehouse" to the North and South Basin trail systems (see Figure 3-2). On-site trails, for the most part, would be on-grade and enhanced with low-key interpretive and orientation signage. Access points to the site from the LARIO Trail, DeForest Avenue, Long Beach Boulevard and near Sutter School would be posted with signs advising users to stay on trails and respect wildlife. The Visitor Center entry would be enhanced by a decorative gate, in keeping with other artistic gateways being developed all along the Los Angeles River. It would include classrooms, six staff office spaces and two volunteer offices, and educational exhibits. Exterior display panel exhibits would provide orientation maps and general information along the public entryway.

Cost Estimates

Total construction costs for this alternative are estimated at $3,044,940. Construction costs do not include additional data collection necessary for final design or further feasibility analysis, but do include estimates of final design, contract specifications, and construction management costs. Total annual maintenance costs for this alternative are estimated at $143,090. Table 3-3 provides a summary of construction and maintenance costs.

TABLE 3-3
Estimate of Construction and Maintenance Costs, DeForest Site Alternative 1

	Estimated Costs[1,2] (2002 dollars)			
Basin	**North Basin**	**Central Basin**	**South Basin**	**TOTAL**
Construction- Habitat Development	$591,984	$221,319	$374,656	$1,187,959
Construction- Public Use		$1,856,980[3]		$1,856,980
TOTAL CONSTRUCTION				**$3,044,940**
Operation/Maintenance (per annum)		$143,090		**$143,090**

Notes:
1. Costs do not include monitoring or additional field testing and feasibility analysis.
2. Planning-level estimates only.
3. Estimate for entire project site- not broken out by basin.

3.2.2 Alternative 2

Alternative Summary

This alternative would involve water augmentation with water requiring treatment, potentially from the Los Angeles River. This alternative would emphasize a treatment marsh in both portions of the North Basin and the Central Basin, and would be appropriate for Los Angeles River water as well as other augmentation scenarios that would augment with water that is more contaminated. The South Basin south of the MSPS would not be regraded for wetland development; instead water would be pumped out at the MSPS. The cost estimating for infrastructure would assume a connection would be established with the Los Angeles River; nevertheless, in final design, the source of the water could be substituted. This would provide an intermediate alternative for cost since the south basin grading, encapsulating the MSPS, and opening flows to DGSG would be avoided. The South Basin would be enhanced to native woodland or scrub. Recreation development would be intermediate in this alternative, and water reuse would be important.

Because the current grade on the South Basin is inverted from the grade in the remainder of the basin that flows north to south, extensive grading would be necessary to allow from gravity flow in a north to south direction south of the MSPS. This alternative proposes pumping out water from the MSPS, or pumping it into the City's recycled system once it reaches the MSPS. Water would be introduced from the Los Angeles River (or other sources) in the North Basin, and then flow south to the MSPS. The South Basin would remain dry except for seasonal storm flooding which occurs now infrequently. To capture storm flows, and use the water to enhance habitat, low depressions are proposed for the South Basin. These would potentially support a perimeter of low riparian vegetation, and would be characteristic of historical conditions when seasonal flooding would leave ponded areas with drying pools.

Grading

In developing the site grade for Alternative 2, side slopes in general were not pushed to any steeper than 3:1, and were left more gradual where the existing terrain permitted it without significantly compromising the wetland area. To provide wetland control points, and flow from north to south, a series of wetland cells are proposed. The northernmost cell in the North Basin would be represented by a mean water surface elevation of 30.5 feet. This elevation would drop by an average of 1 foot through a series of three cells in the Central Basin, with the final cell having a water surface elevation of 26.5 feet before flowing into a sand filtration system; from this vertical flow cell water would be pumped into the recycled water system, or bypass may flow into the MSPS channel, which is at about 25.6 feet elevation. The detailed grading plan is provided in the *Task 5 Report.*

Soils have a high fraction of sand; however, within wetland basins it is expected that organic material resulting from plant growth and fine deposition would eventually seal the soils and reduce infiltration. As such, no soil engineering or augmentation is necessary.

Utilities and Infrastructure

Water supply for Alternative 2 would consist of existing flows from the storm drains with flow augmentations from the Los Angeles River. Flow augmentation from the Los Angeles

River would range between 0.4 and 0.5 cubic feet per second (cfs). The infrastructure requirements for the Los Angeles River diversion are described in detail in the *Task 5 Report*, and include a diversion and pipeline from the river, originating at the low flow channel at an approximate elevation of 33.0 feet. The elevation at the outlet into the DeForest Site would occur at around an elevation of 32.0 feet. Water levels in the Los Angeles River are typically up to the top of the low flow channel, which provides for over 5 feet of drop total. The diversion structure would have a remotely operated slide gate to block off the diversion during high or storm flow periods when augmentation of flow is not required at the site.

The conceptual design for the Los Angeles River diversion outlet detail consists of an 20-inch pipeline outlet with headwall entering a spillway. The spillway, which would act to slow the flow, consists of 20-foot-long by 26-foot-wide concrete slab with inset cobbles. The spillway provides a gradual drop in elevation from the pipe outlet to the wetland. In addition to the concrete slab, riprap is located at the toe of the slope to protect the stability of the concrete as well as protect against erosion of the ground surface. A similar spillway design would be utilized at the two storm drain outlets that enter the north portion of the North Basin at the DeForest Site. Trash removal systems, as described under Alternative 1, would be installed at all storm drain outlets.

Additional infrastructure associated with the wetland includes water control structures separating the different wetland cells consist of earthen berms with flow control mechanisms incorporated into the berms, erosion protection (consisting of rip-rap) for the bridge piers along the channel passage under the North Long Beach Boulevard overpass, and a vertical-flow treatment cell, which would augment treatment accomplished through the surface-flow wetlands. Vertical-flow cells would be located at the south end of the Central Basin, consisting of a pair of vertical-flow cells comprised of a sand filter mixed with iron shavings. This composition has proven effective at lowering coliform bacteria counts.

There is one significant utility conflict for Alternative 2, consisting of the 42-inch and 33-inch sewer lines that are encased in concrete and cross the Central Basin north of the Market Street Pump Station. In the Alternative 2 design, this exposed structure would be covered and protected in concrete and rip-rap, and used as part of the water control weir for Cell 1 in the Central Basin.

Water Supply

A full description of the Los Angeles River is provided in *Task 3 Report*. The channel is concrete along the DeForest Site, and has perennial flow ranging from substantial flood flows to low flows in summer months. The lower Los Angeles River is fully apportioned, meaning that water rights would be necessary prior to any diversion for use in support of a wetland at DeForest Park. The LACDPW may have an existing water right for the Los Angeles River; Alternative 2 presumes that Los Angeles River water would be available for a project on DeForest Site.

A revised water budget was developed from the preliminary budget provided in *Task 3 Report*, based on more precise information on wetland cell size and water supply. Alternative 2 has water conserving on-demand flow augmentation scenario with unaugmented peak flows that occur between December and February of between 35 and 60 million gallons per month (British units; MG/mth [2 to 4 cfs]). Water augmentation

begins in March at 3.4 MG/mth (0.20 cfs) and ramps up to about 8.4 MG/mth (0.50 cfs) between April and October, when it ramps back down. This input flow is sufficient to maintain outflow from the treatment wetland in the Central Basin (Basin 2) of between 4.5 and 12.8 MG/mth (0.27 to 0.77 cfs) during the drier months. A total flow augmentation of 64 MG per year (235 acre-feet per year [afy]) is required to maintain flow under this scenario. Figures 3-3a and b illustrate outflow from the treatment wetland in Alternative 2, averages for cfs and MG/mth.

The amount of water augmentation is not determined by available water (low flow in the Los Angeles River is generally in excess of 10 cfs), but rather by the treatment capacity of the wetland. The given water budget was developed assuming water would be treated with a sand filtration vertical flow cell to treat for fecal coliform levels, and that treatment would be to Title 22 standards for water reuse.

Basin Operations

No alteration of pump station operations at the MSPS is proposed under this alternative. Pump station operation would continue under the current regime, as described in *Task 3 Report*. Under this operation, the basins may be inundated during flood events. Once pumps are operational, it is generally less than a day before the basin is drained again; wetland cells and associated infrastructure would be designed to withstand prolonged inundation. However, treatment capacity would be suspended during periods of inundation.

An increase in flood storage capacity is anticipated from development of Alternative 2 of up to 9.168 acre-feet.

Biological Resources

Proposed vegetative communities and habitat types under Alternative 2 are illustrated in Figures 3-4a through c. A cross-section rendering of typical plant communities and wetland elevations is provided in Figure 3-5. Total acreage of habitats resulting under this alternative is provided in Table 3-4. These habitat types are integrated with grading designs, with vegetative communities proposed along appropriate hydric gradients. Objectives in the habitat design were to develop a mosaic of habitats characteristic of historic conditions, to maintain the current woodland characteristics of the North Basin, and to integrate with treatment wetland designs and other site constraints. A more complete description of vegetative communities and habitat components is provided in the *Task 5 Report*, along with plant palettes for vegetative communities.

Vegetative communities would include shallow marsh, caracterized by freshwater emergent wetlands in areas of shallow, permanent or semipermanent inundation. Species may include bulrush, cattail, tall flatsedge, duckweed, sedge, rush, and others. Shallow marsh represents the area within a treatment wetland that provides the most organic surfaces for treatment chemical reactions. Deep marsh would be characterized by freshwater, permanently inundated areas with water generally between 2 and 5 feet deep; plant species typically occupying these areas include submerged plants including pondweed (*Potamogeton* spp.), water starwort (*Callitriche marginata*), and waterweed (*Elodea* sp.). Deep marsh represents the area within a treatment wetland that provides mixing of water as it passes through the treatment wetland.

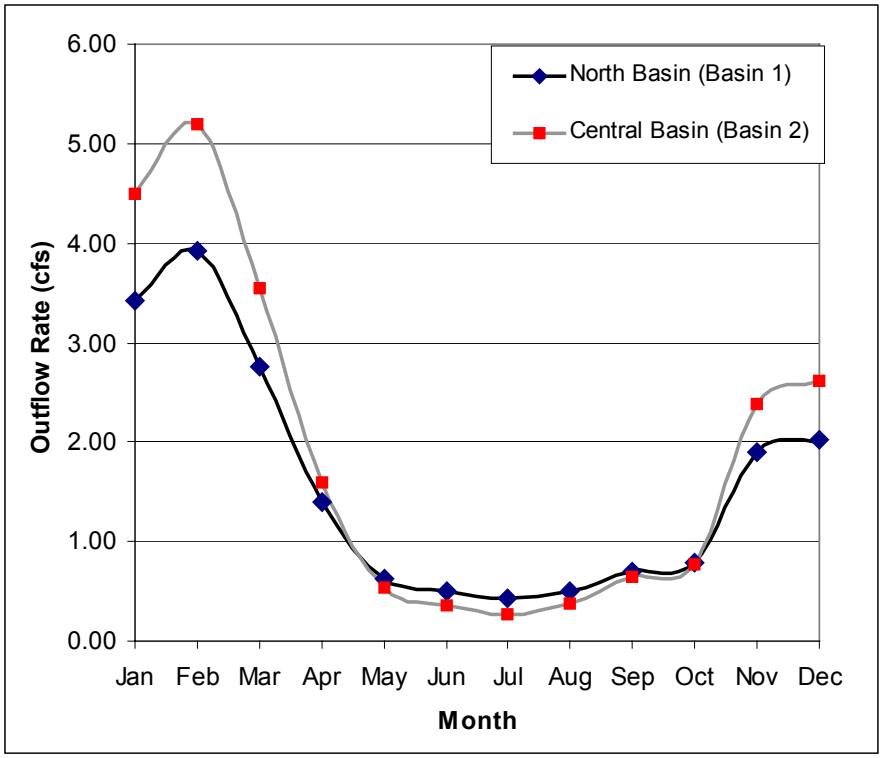

Figure 3-3a. Monthly Water Budget Outflow (cfs), DeForest Site Alternative 2

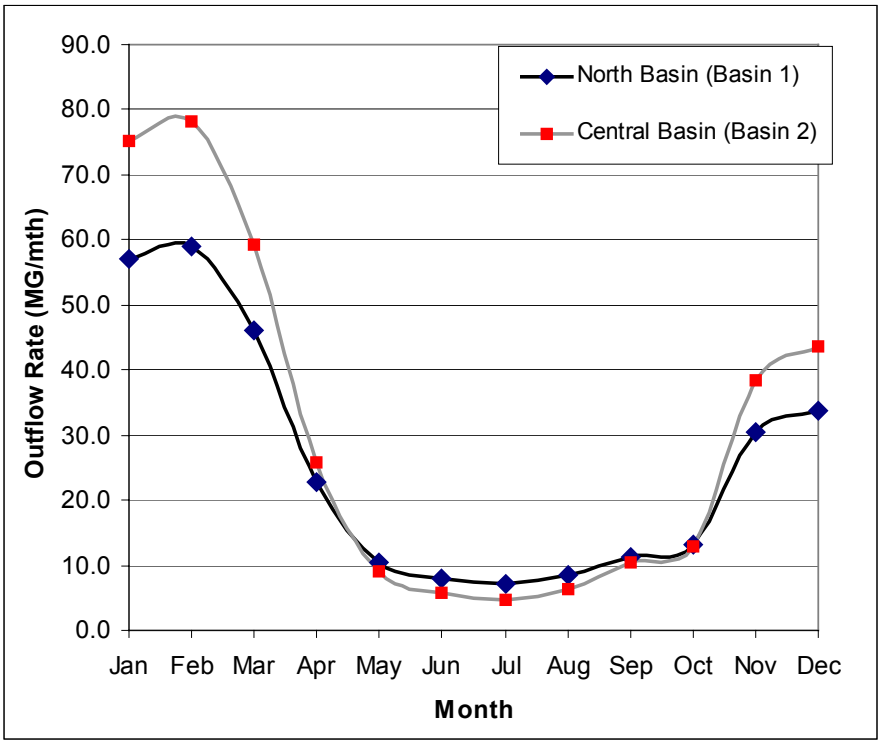

Figure 3-3b. Monthly Water Budget Outflow (MG/mth), DeForest Site Alternative 2

Low riparian woodland would be developed on areas adjacent to permanent water, but generally inundated only during storm events; it would typically support shrubby to woodland growth of willows, including Goodding's willow, sandbar willow, and narrow-leaf willow (*Salix exigua*), as well as more hydric species including rush, sedge, tall flatsedge, and common plantain. A high riparian woodland is planned for areas currently occupied by non-native woodland at the DeForest Site, and in a mix with native scrub in other upland areas. Areas currently occupied by non-native woodland species would be replaced with native riparian woodland species, including Fremont's cottonwood, Mexican elderberry, mulefat, and other species. In general, an open woodland canopy would be developed, with dense vegetation restricted to pockets. Native Scrub would be mosaiced with high riparian areas on DeForest Site; species may include dune buckwheat, California croton, coastal locoweed, goldenbush, and others.

Temporary pools are proposed for Alternative 2 in the South Basin, as shown in Figure 3-4c. These would be represented by low depressional areas excavated in the South Basin to capture floodwaters during flooding events that inundate the DeForest Basin. These types of drying pools would be characteristic of historic habitat conditions after flood events in the lower Los Angeles Basin, where river overflows would typically inundate large areas, leaving drying pools. It is anticipated that native riparian vegetation and wetland vegetation would be established along the perimeter of these pools, and the pools will benefit many species of wildlife.

TABLE 3-4
Proposed Acres of Habitat by Basin, DeForest Site Alternative 2

	Acres of Habitat (Intact Existing)[1]			
Zone	**North Basin**	**Central Basin**	**South Basin**	**SITE TOTAL**
Deep Marsh	0.30	0.54	---	**0.84**
High Riparian	4.92 (1.67)	0.85	6.21 (0.07)	**11.97 (1.73)**
Low Riparian	2.16 (0.85)	1.36 (0.01)	0.84 (0.41)	**4.37 (1.28)**
Native Scrub	4.02 (0.76)	2.85	6.44 (0.68)	**13.31 (1.44)**
Shallow Marsh	1.79 (0.69)	2.05 (0.06)	---	**3.83 (0.74)**
Temporary Pool	---	---	0.43	**0.43**
BASIN TOTAL	**13.19 (3.97)**	**7.65 (0.07)**	**13.91 (1.15)**	**34.75 (5.19)**

Notes:
1. Portions of existing native habitat would be left intact, with the remainder restored/enhanced; Acres of Habitat includes intact existing plus restored habitat. Existing habitat left intact indicated exclusively in parenthesis.

Recreational/Public Use Resources

Under Alternative 2, public use would be accommodated at an intermediate level compared with the other alternatives. Opportunities would still be provided for low-level passive public use and elementary education. A moderately sized Visitor Center would be established along DeForest Avenue, which would serve as a "gatehouse" to the trail systems (see Figure 3-6). The Visitor Center would include classrooms, offices, and a display counter for ecologically-oriented literature and gift items. Exterior display panel exhibits would provide orientation maps and general information along the public entryway. Alternative 2,

bus and public parking for the Visitor Center would be accommodated either on-street along DeForest Avenue or in the existing DeForest Park lot a few hundred feet to the north. A conceptual section rendering of the proposed public use plan under Alternative 2 is presented in Figure 3-7.

For the trail system, a looped boardwalk trail would be developed for accessing the various habitat types, and observation platforms with interpretive sign panels would be established at key points. Other trails in the North and South Basin would be on-grade and enhanced with low-key interpretive and orientation signage, and occasional benches for quiet contemplation. Access points to the site from the LARIO Trail, DeForest Avenue, Long Beach Boulevard and near Sutter School.

Treatment Capacity

Water quality improvement by DeForest Site Alternative 2 was estimated using the first-order treatment wetland model developed by Kadlec and Knight (1996). The model applies empirical pollutant removal rates to the estimated inflow concentration, flow rate, and wetland area to project final outflow concentrations. More detail on model criteria and assumptions, as well as treatment processes, is provided in the *Task 5 Report.* Table 3-5 provides the model output for two output scenarios. In summary, all Title 22 standards for reuse can be accomplished at these flow levels, but a final filtering device (vertical-flow cell/sand filtration system) would likely be needed to achieve this.

TABLE 3-5
Estimated Treatment Performance, DeForest Site Alternative 2

			Low Flow (0.4 cfs)	High Flow (0.5 cfs)
Parameter	**Units**	**Los Angeles River Influent[1]**	**Wetland Effluent**	**Wetland Effluent**
BOD	mg/L	9.2	5.1	5.5
TSS	mg/L	333	<15 (background levels)	<15 (background levels)
Ammonia Nitrogen (NH_3-N)[2]	mg/L	0.14	<0.1	<0.1
Nitrate-nitrite-Nitrogen	mg/L	0.91	0.3	0.4
Total Nitrogen	mg/L	2.4	<1.5	<1.5
Fecal Coliform	colonies per 100 ml	393,000	13,500	26,000
Total Phosphorus	mg/L	0.41	0.24	0.27
Hydraulic Loading Rate	cm/d	-	6.0	7.5
Nominal Hydraulic Residence Time	days	-	6.3	5.1

1. Values are annual mean concentrations for 1999-2000, taken at Sampling Site 10 (between Wardlow and Willow Roads, Long Beach). Source: LACDPW, 2001.
2. Ammonia-nitrogen is assumed to be in the form of ammonium for use of this model
   An average winter temperature of 15 degrees C was assumed.

Increasing wetland size to include the South Basin (as would occur under Alternative 3) would result in approximately 8 acres of wetland. Keeping the hydraulic loading rates equal would provide the same water quality improvements as those outlined in Table 3-5 and would result in treatment flow rate capacity of approximately 1.0 cfs.

Cost Estimates

Total construction costs for this alternative are estimated at $7,145,680. Construction costs do not include additional data collection necessary for final design or further feasibility analysis, but do include estimates of final design, contract specifications, and construction management costs. Total annual maintenance costs for this alternative are estimated at $228,552. Table 3-6 provides a summary of construction and maintenance costs. More detail on the cost estimates is provided in the *Task 5 Report.*

TABLE 3-6
Estimate of Construction and Maintenance Costs, DeForest Site Alternative 2

Basin	Estimated Costs[1,2] (2002 dollars)			
	North Basin	Central Basin	South Basin	TOTAL
Construction- Habitat Development	$2,247,605	$1,838,435	$456,301	$4,542,341
Construction- Public Use		$2,603,339[3]		$2,603,339
TOTAL CONSTRUCTION				**$7,145,680**
Operation/Maintenance (per annum)		$228,552		**$228,552**

Notes:
1. Costs do not include monitoring or additional field testing and feasibility analysis.
2. Planning-level estimates only.
3. Estimate for entire project site- not broken out by basin.

3.2.3 Alternative 3

Alternative Summary

This alternative would involve constant water augmentation, generally with cleaner water where treatment was not necessary; the potential water source for this alternative was identified as the Caltrans I-105 water. This alternative would emphasize maximum habitat in the North, Central, and South Basins, with the South Basin regraded to allow water to flow through the South Basin to a hydrologic connection with DGSG. Because the current grade on the South Basin is inverted from the grade in the remainder of the basin that flows north to south, extensive grading would be necessary to implement this alternative. The MSPS would be encapsulated to allow flow-by for the wetland.

This alternative would emphasize maximum wetland habitat development, and would provide opportunity for development of additional habitat components, including barren nesting islands for ground-nesting water birds, larger, deeper open-water wetland cells for species of waterfowl that prefer to loaf or forage on open water, and areas that could be managed for mudflats for shorebird foraging. This alternative would involve enlarging the marsh area in the North Basin, and develop marsh in the Central and South Basins. Upland

areas would be variably developed with high riparian woodland or native scrub habitats. Recreational development would be maximized under this alternative, with trails, boardwalks, and overlooks in wetland areas.

Grading

In developing grading, sideslopes were left a minimum of 3:1; sideslopes in the South Basin in some locations were left at relatively low angles, to provide more gradual transitions into the wetland. To provide wetland control points, and flow from north to south, a series of wetland cells are proposed. The northernmost cell in the North Basin would be represented by a mean water surface elevation of 30.5 feet. This elevation would drop by an average of 1 foot through a series of three cells in the Central Basin, with the lowest cell in the Central Basin having a water surface elevation of 26.5 feet before water would pass through a siphon under the MSPS into the South Basin. In the South Basin, a total of three cells would be developed, also dropping an average of 1 foot between basins. The final cell in the South Basin would have an average water elevation of 23.5 feet. From this cell, water would pass through to DGSG, which generally operates at 22.5 feet water elevation.

Utilities and Infrastructure

Water supply for Alternative 3 would consist of existing flows from the storm drains with flow augmentations from the Caltrans I-105 water. Flow augmentation from the Caltrans I-105 water would range between 3 and 8 cfs. The Caltrans I-105 water would be pumped to the DeForest Site through a pipeline, which was not included in the conceptual design. A conceptual design for an outlet was developed; the elevation that the I-105 water enters the DeForest Site would occur at around an elevation of 32 feet. The outlet design, and the design for storm drain rehabilitation, would be similar to designs described under Alternative 2. Trash removal systems would also be installed, as described under Alternatives 1 and 2, and water control structures would also be comparable.

A bypass was originally proposed in the *Task 5 Report* under the existing Market Street Pump Station and Drain, to allow flow through from the Central to the South Basin, without interfering with pump station operation. However, in the final TAC Meeting, the LACDPW indicated they didn't think this would be necessary. Alternatively, the MSPS could remain flooded with wetlands flows passing through and overtopping the existing facility. This will require additional investigation.

To complete the hydrology for this Alternative, an outlet to DGSG would be required, allowing I-105 water to flow to DGSG for recharge. The outlet would flow from the DeForest Basin at an elevation of approximately 23.5 feet and enter the Dominguez Gap Basin at an elevation of approximately 22.5 feet, with approximately 320 feet of pipeline required.

Water Supply

A full description of the I-105 water is provided in the *Task 3 Report.* This water is a potential water supply source resulting from Caltrans removal of groundwater from the Central Basin, where Caltrans is currently pumping the water out of the basin to protect the I-105 Freeway near its intersection with the Los Angeles River and the 1-710 Freeway. This alternative is not dependent on I-105 water, but was developed to best address flow-

through of this water in the DeForest Basin into DGSG. Other water sources could be substituted in this habitat design if the amount of water was comparable to that available from I-105.

A revised water budget is developed and described in the *Task 5 Report*. This alternative represents a constant water augmentation scenario with augmentation occurring at 3.1 cfs (50 MG/mth). A total flow augmentation of 602 MG per year (2240 afy) would occur under this scenario. Outflow to the DGSG under this alternative would range from 47 MG/mth (2.8 cfs) in the dry months to 147 MG/mth (9.8 cfs) in winter months, depending on the extent of storm flows intercepted at the MSPS. This augmentation would support abundant wetland habitat throughout the North, Central, and South Basins. Figures 3-8a and b show outflow from the wetland basins under this alternative in both cfs and MG/mth.

Basin Operations

No alteration of pump station operations at the MSPS is proposed under this alternative. Pump station operation would continue under the current regime; as such, wetland cells in the Central and South Basins would flood before pump station operation is initiated, and wetland cells in the North Basin would flood before all four pumps are operational. Wetland cells and associated infrastructure would be designed to withstand prolonged inundation. However, under the proposed alternative design, the South Basin would in general be below the elevation of the MSPS; as such, excessive floodwaters draining into the South Basin would need to flow through to DGSG to be eliminated at the Dominguez Gap Pump Station. Dominguez Gap Pump Station operations would have to be evaluated to determine if there is capacity for this additional flood flow.

Table 3-7 shows the estimated change in existing storage capacity under Alternative 3; as indicated, an increase is anticipated.

TABLE 3-7
Estimated Change in Flood Storage Capacity, DeForest Basin, Alternative 3

Basin	Change in Storage Capacity (acre-feet)
North Basin	+3.097
Central Basin	+3.770
South Basin	+24.799
TOTAL	**+31.641**

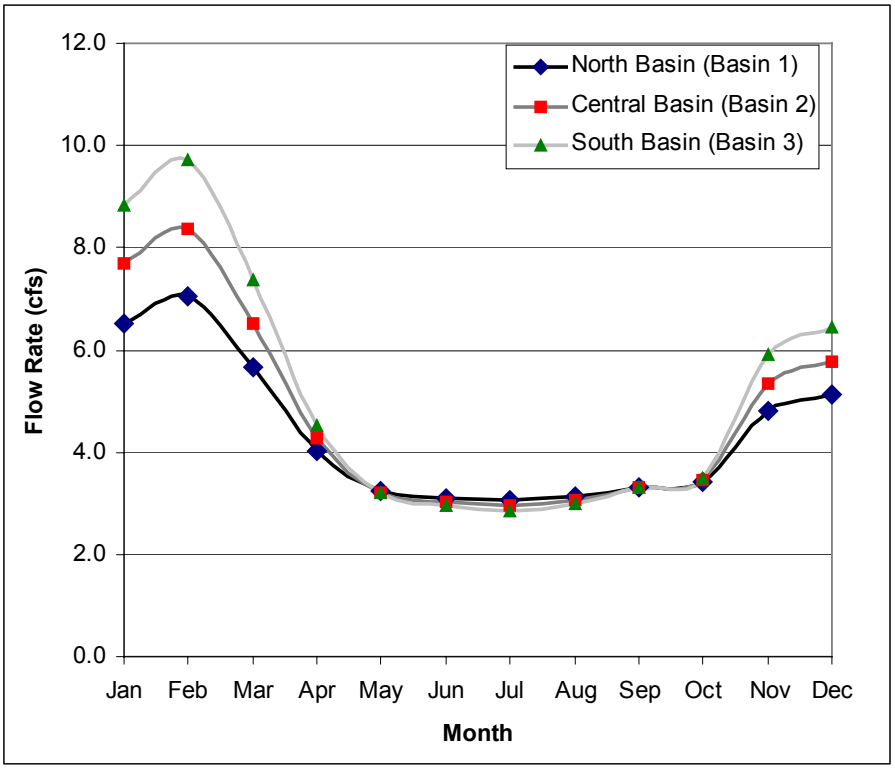

Figure 3-8a. DeForest Site Alternative 3- Monthly Water Budget Outflow (cfs)

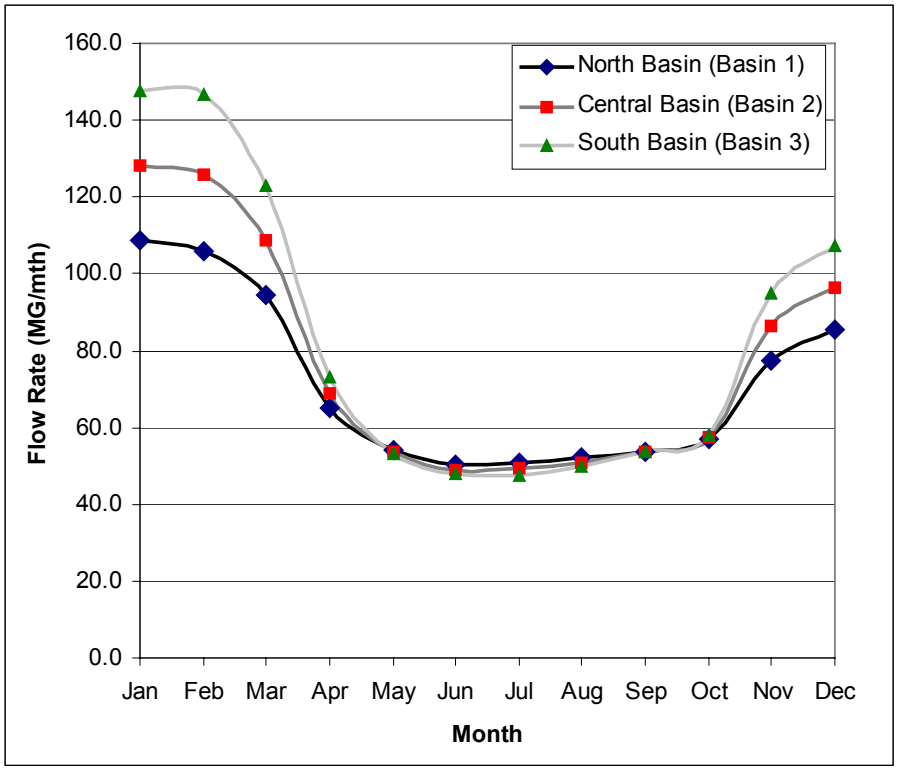

Figure 3-8b. DeForest Site Alternative 3- Monthly Water Budget Outflow (MG/mth)

Biological Resources

Proposed vegetative communities/habitat types for the DeForest Site under Alternative 3 are presented in Figures 3-9a-c. A cross-section rendering of typical plant communities and wetland elevations is provided in Figure 3-10. Acreage of proposed new or enhanced habitat by basin are presented in Table 3-8. A revised plant palette for vegetative communities proposed for the DeForest Site is provided in Appendix A. The restoration plan would include shallow marsh of freshwater emergent wetlands in areas of shallow, permanent or semipermanent inundation; species may include bulrush, cattail, tall flatsedge, duckweed, sedge, rush, and others. Extensive shallow marsh areas would be developed in the North, Central, and South Basins under this alternative. Deep marsh areas would be developed in a mosaic with shallow marsh, islands, and other habitat features under this alternative; plant species typically occupying deep marsh include submerged plants including pondweed, water starwort, and waterweed. Low riparian would be characterized by areas adjacent to permanent water, but generally inundated only during storm events. These areas typically support shrubby to woodland growth of willows, including Goodding's willow, sandbar willow, and narrow-leaf willow, as well as more hydric species including rush, sedge, tall flatsedge, and common plantain. Areas currently occupied by non-native woodland species would be replaced with a high riparian woodland, including Fremont's cottonwood, Mexican elderberry, mulefat, and other species. In general, an open woodland canopy would be developed, with dense vegetation restricted to pockets. Native scrub will be developed in a mosaic in upland areas; species may include dune buckwheat, California croton, coastal locoweed, goldenbush, and others.

TABLE 3-8
Proposed Acres of Habitat by Basin, DeForest Site Alternative 3

	Acres of Habitat (Intact Existing)[1]			
Zone	**North Basin**	**Central Basin**	**South Basin**	**SITE TOTAL**
Deep Marsh	0.14	0.76	0.64	**1.54**
High Riparian	4.92 (1.64)	0.85	1.61 (0.07)	**7.38 (1.71)**
Low Riparian	2.44 (0.90)	1.43 (0.01)	2.17 (0.15)	**6.04 (1.06)**
Nesting Island	---	---	0.12	**0.12**
Open Water	---	---	1.03	**1.03**
Native Scrub	4.02 (0.76)	2.85	6.50 (0.68)	**13.37 (1.44)**
Seasonal Mudflat	---	---	0.38	**0.38**
Shallow Marsh	1.66 (1.04)	1.83 (0.06)	2.05	**5.54 (1.10)**
BASIN TOTAL	**13.18 (4.34)**	**7.72 (0.07)**	**14.49 (0.89)**	**35.39 (5.30)**

Notes:
1. Portions of existing native habitat would be left intact, with the remainder restored/enhanced; Acres of Habitat includes intact existing plus restored habitat. Existing habitat left intact indicated exclusively in parenthesis.

Additional habitat components would include open water, characterized by larger, deeper, open-water wetland cells for species of waterfowl that prefer to loaf or forage on open water. Seasonal mudflats are proposed for portions of wetland cells in the South Basin. This habitat would be maintained by management actions to provide forage for shorebirds and other water birds. Nesting islands are proposed for ground-nesting birds in portions of wetland cells in the South Basin; active management of site vegetation would keep the islands barren, thus making them attractive to species like black-necked stilt, killdeer, and American avocet.

Recreational/Public Use Resources

Under Alternative 3, public use would be accommodated at a relatively high level compared with the other alternatives. There would be a deliberate balance between accommodations for elementary education and enhanced opportunities for passive public use. A Visitor Center—larger than in the other alternatives—would be established along DeForest Avenue; it would serve as a "gatehouse" to the North and South Basin trail systems (see Figure 3-11). Orientation maps and general ecological information would be located within the Visitor Center on a viewing deck overlooking the North Basin wetlands, and a double looped boardwalk trail system would be developed that would launch from the Visitor Center. Observation platforms with interpretive sign panels would be established at key points for teacher discussions. Other trails in the North and South Basin would be enhanced with interpretive panel exhibits, observation platforms, benches and orientation signage, at a higher density than in the other alternatives. Three additional raised viewing decks/rest areas would be developed directly off the LARIO trail, overlooking the North, Central and South Basin wetlands.

Access points to the site from the LARIO Trail, DeForest Avenue, Long Beach Boulevard and near Sutter School would be posted with signs advising users to stay on trails and respect wildlife. Decorative gates, consistent with the artistic image being developed all along the LARIO system, would be designed. Under Alternative 3, off-street public parking lots for site and trail access would be developed both at the Visitor Center along DeForest Avenue, and between 51st and 52nd Streets near Sutter School. Busses would not be anticipated at the 51st/52nd Streets site, and would be expected to park on the street at the Visitor Center site.

Treatment Capacity

Alternative 3 was not developed as a treatment alternative, although the existing wetland design would be anticipated to provide some water quality improvement. However, the extent of improvement was not analyzed.

Cost Estimates

Total construction costs for this alternative are estimated at $11,637,311. Planning-level estimates of construction and maintenance costs by basin for Alternative 3 are provided in Table 3-9. Construction costs do not include additional data collection necessary for final design or further feasibility analysis, but do include estimates of final design, contract specifications, and construction management costs. Total annual maintenance costs for this alternative are estimated at $225,959. More detail on the cost estimates is provided in the *Task 5 Report.*

TABLE 3-9
Estimate of Construction and Maintenance Costs, DeForest Site Alternative 3

Basin	Estimated Costs[1,2] (2002 dollars)			
	North Basin	Central Basin	South Basin	TOTAL
Construction- Habitat Development	$1,308,103	$1,367,305	$5,331,259	$8,006,668
Construction- Public Use		$3,630,643[3]		$3,630,643
TOTAL CONSTRUCTION				**$11,637,311**
Operation/Maintenance (per annum)		$225,959		**$225,959**

Notes:
1. Costs do not include monitoring or additional field testing and feasibility analysis.
2. Planning-level estimates only.
3. Estimate for entire project site- not broken out by basin.

3.3 Final Sixth Street Site Conceptual Designs

3.3.1 Alternative 1

Alternative Summary

The first alternative would be to enhance existing conditions with native vegetation, and develop a bicycle wayside. This alternative would involve no water augmentation and minimal site grading, and would be the least expensive. Native scrub or woodland habitats would be emphasized on the site. Current plans for a connection to the Los Angeles River Bicycle Trail (LARIO) on the site would be implemented.

The alternative emphasizes creating a pocket park or bicycle wayside, creating an aesthetically appealing rest stop for LARIO users or local school children, with interpretive displays, creative facility development, and other amenities. Proposed revegetation under this alternative would emphasize eliminating exotic species, and planting currently disturbed or unvegetated areas with native dune scrub plantings. Existing native vegetation including sycamore and willow plantings along the Los Angeles River levee, and the small patch of native marsh vegetation in the south portion of the site, would be left intact, but non-native landscape plants along Shoreline Drive would be replaced with native scrub.

Physical Development

No site grading is proposed for this alternative; the native grade would be unaltered. Soils in general would not be altered for this alternative; some ripping of compacted soils may be necessary prior to planting, but sandy soils do appear suitable to support the proposed dune scrub vegetative associations. Some mulch or organic material additives may be placed in native soil in individual shrub or tree planting locations where appropriate.

Utilities and Infrastructure

On-site irrigation would be necessary during the establishment stages for native shrubs, but aside from installation of this system, no additional infrastructure is required for Alternative 1, and no infrastructure conflicts are anticipated under this alternative.

Water Supply

No water augmentation on-site is proposed for Alternative 1. Water requirements for this alternative would be limited to irrigation supply for native shrub plantings; this could be provided from the City's recycled system, or from domestic supplies.

Basin Operations

No change to existing pump station operations is proposed for Alternative 1, and since the surface of the site is not used for flood storage, there would be no issues for flood storage capacity under this alternative.

Biological Resources

Figure 3-12 shows the proposed vegetation communities under Alternative 1 for the Sixth Street Site. A total of 3.58 acres of native scrub habitat would be created under this alternative. The existing 0.09 acres of emergent marsh and 0.52 of riparian vegetation would be left intact, for a total of 4.19 acres of onsite native habitat. A more complete description of these native plant communities is provided in the *Task 3 Report*, and a plant palette provided in the *Task 5 Report.* The proposed native scrub habitat would be consistent with that which historically occurred in coastal areas in the lower Los Angeles Basin along drier terraces, and potentially where blowing sand or alluvial deposition was occurring. Species may include dune buckwheat, California croton, coastal locoweed, goldenbush, and others. In addition, some native riparian trees may be planted where picnic or rest locations are installed, but in general, wooded habitat would not be emphasized under this alternative.

Recreational/Public Use Resources

Under Alternative 1, public use would be accommodated at a relatively low level in providing opportunities for passive use and elementary education. A bicycle trail linkage would be provided across the site from the Seventh Street undercrossing to the LARIO trail. A LARIO rest area, with view bench and bike rack, would be constructed at the link/main trail intersection. For on-site trails, the relative homogeneity and low height of the scrub vegetation planned under Alternative 1 justify an uncomplicated on-site trail layout (see Figure 3-13). The site would become a "pocket park" designed for short exploratory visits and brown-bag lunches. Trails would be on-grade, enhanced with low-key interpretive and orientation signage, and lined with low barriers to discourage wandering that could trample vegetation and cause soil compaction or erosion. Trailside benches would be tucked into sunny and shady spots. Site access under Alternative 1 would be from the LARIO trail for trail users; under the Shoemaker Bridge for residents to the north of the site; and via the Seventh Street undercrossing for educational groups parking at Edison School and/or park users venturing in from Cesar Chavez Park. Decorative pedestrian/bicycle entry gates would be located east of the Seventh Street undercrossing to "announce" the site's existence and to discourage improper usage.

Cost Estimates

Total construction costs for this alternative are estimated at $285,168. Construction costs do not include additional data collection necessary for final design or further feasibility analysis, but do include estimates of final design, contract specifications, and construction management costs. Cost estimates are preliminary based on conceptual designs, and should

only be used for planning-level purposes. Total annual maintenance costs for this alternative are estimated at $25,880. Planning-level estimates of construction and maintenance costs by basin for Alternative 1 are provided in Table 3-10.

TABLE 3-10
Estimate of Construction and Maintenance Costs, Sixth Street Site Alternative 1

Basin	Estimated Costs[1,2] (2002 dollars)
Construction- Habitat Development	$116,024
Construction- Public Use	$169,145
TOTAL CONSTRUCTION	**$285,168**
Operation/Maintenance (per annum)	**$25,880**

Notes:
1. Costs do not include additional field testing or feasibility analysis.
2. Planning-level estimates only.

3.3.2 Alternative 2

Alternative Summary

This alternative would involve creation of a freshwater marsh on the site using existing/enhanced stormwater. Water would be supplied from the existing storm drain on the site using a pump, bringing water up to the existing site elevation. Most of the northern portion of the site would be graded into a basin configuration to support wetland habitat, but the elevations would not be significantly altered. The water would be allowed to flow onto the native grade on the south of the site before draining back into the storm drain system. Non-native vegetation on the site would be removed and replaced with native vegetation, including scrub, wetland, or riparian vegetation. Public use would be developed to access the marsh area. Current City plans for a connection to the LARIO on the site would be implemented, and some facilities for a bicycle way-station would be developed.

This alternative would emphasize maximum wetland habitat development, and would provide opportunity for development of multiple habitat components, including shallow and deep marsh areas, low riparian woodlands, and upland native scrub or high riparian woodland. Recreational development would be extensive under this alternative, with trails, boardwalks, and overlooks in wetland areas.

Physical Development

The proposed grading for Alternative 2 would involve a total of two wetland cells with controlled water elevations, one just north of the Sixth Street Pump Station, and one west of the pump station. A small pump would be located on the east side of the pump station to pump storm drain discharge to the first cell, which would have a mean water surface elevation of 12.0 feet msl. Perimeter berms along this cell would be up to 15.0 feet msl, with a 3:1 sideslope ratio. Water would flow north in this cell, to a water control structure at the north end, where water would drain into the second cell, at mean water elevation of 11.5 feet. The native grade on the west side of this cell would be adequate to contain the

wetland, keeping the water from abutting the river levee. Water would flow south in this cell to a water control structure at the south end. At this point water would drain to the native grade, which is about 8.5 feet in this location. A small containment berm on the east side of this south portion would have sideslope ratios of 5:1, and would have a top elevation of 10.0 feet.

Soils have a high fraction of sand; however, within wetland basins it is expected that organic material resulting from plant growth and fines would eventually seal the soils and reduce infiltration. As such, no soil engineering or augmentation is anticipated to be necessary.

Utilities and Infrastructure

Infrastructure required for implementation of Alternative 2 includes the following: (1) a pump system, which would be installed near the Sixth Street Storm Drain, to supply water to the wetland from the existing storm drain system; this would include a small structure to house the pump, and a pipeline leading from the storm drain well to the head of the wetland; (2) an outlet of the wetland which would be at the south side of the Sixth Street Site, where a small concrete inlet structure would channel the water into a drain pipe; this would then connect with an unused storm drain which empties into the Los Angeles River just south of the site; and, (3) water control structures separating the different wetland cells consisting of earthen berms with flow control mechanisms incorporated into the berms; flow control could be accomplished with gate valves or traditional stop log controls.

Potential infrastructure conflicts from Alternative 2 include inadequate access to the existing Sixth Street Pump Station, access to the utility bridge which crosses the Los Angeles River, and protection of the northern storm drain, which enters the Sixth Street Pump Station. All of these potential conflicts can be resolved during design, by providing alternative access points for the utility bridge and pump station, and by integrating the subsurface storm drain into design of water control structures and/or berms in the wetland. This will require further evaluation of the storm drain design.

Water Supply

A more complete description of the City's storm drain system is provided in the *Task 3 Report*. The storm drain system encompasses a watershed that is 438 hectares (1,083 acres) in size, situated in the southwestern portion of the City, and comprised of residential use, commercial use, industrial use, institutional use, and open space. A revised water budget was developed from the preliminary budget provided in *Task 3 Report*, based on more precise information on wetland cell size and water supply. The details of how the water budget was developed for the Sixth Street Site, as well as the water budget, are provided in the *Task 5 Report.*

This alternative represents a constant water augmentation averaging 1.66 MG/mth (0.10 cfs); this results in a total augmentation of 19.9 MG per year (73 afy). This augmentation is limited by the amount of water estimated as being available in the storm drain; output of the wetland under this scenario is estimated to be just under 0.10 cfs. Figures 3-14a and b show the monthly total outflow from the wetland in MG/mth and cfs, respectively. This flow would be adequate to maintain shallow marsh, deep marsh, and low riparian wetland vegetation as designed.

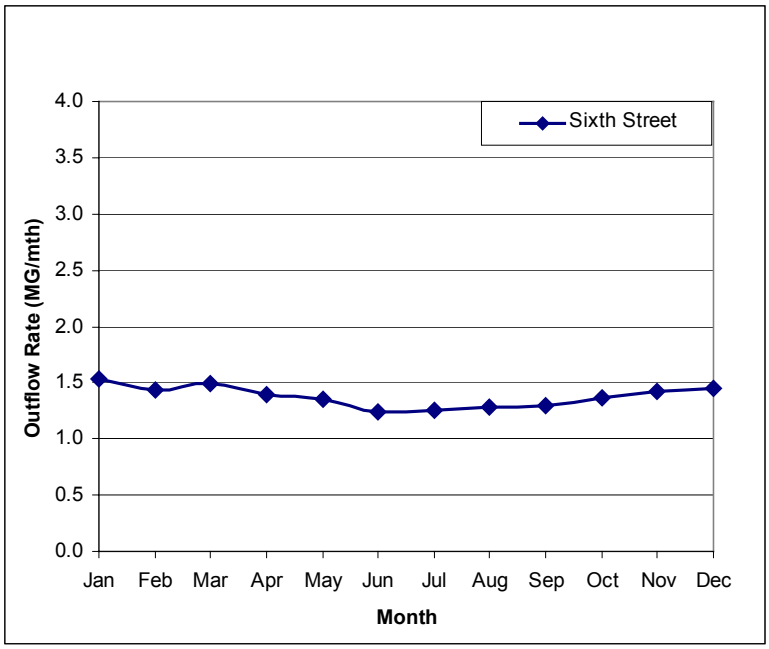

Figure 3-14a. Sixth Street Alternative 2- Monthly Water Budget Outflow (MG/mth)

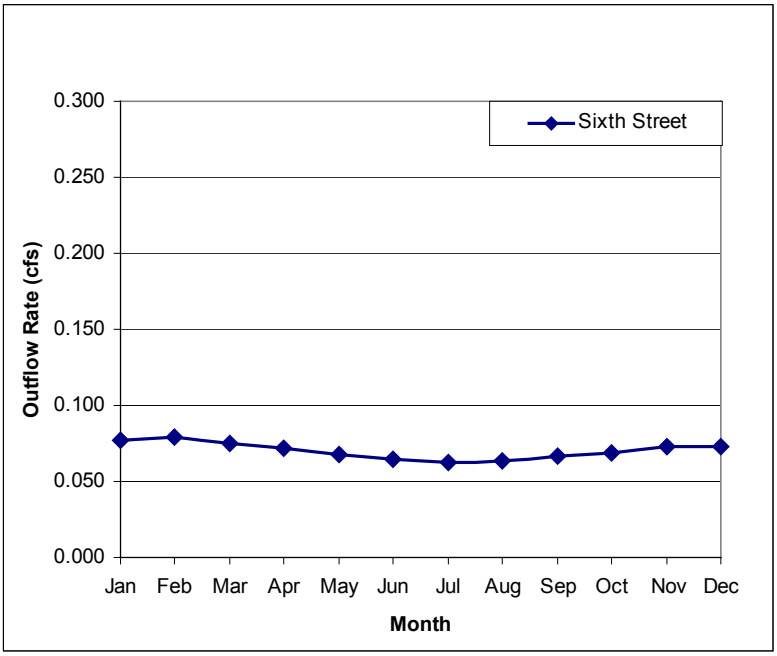

Figure 3-14b. Sixth Street Alternative 2- Monthly Water Budget Outflow (cfs)

Basin Operations

No alteration to existing pump station operation is anticipated under this alternative. Stormwater would be pumped into the wetland through a separate pump system, which would operate independently of the Sixth Street Pump Station. Water originating in the storm water system would be released to the river after passing through the wetland, and would not interfere with pump station operations.

Biological Resources

Vegetation communities proposed for the Sixth Street Site under Alternative 2 are presented in Figure 3-15. A cross-section rendering of typical plant communities and wetland elevations is provided in Figure 3-16. A summary of proposed acreage under this planting plan is provided in Table 3-11. A more complete description of these communities is provided in the *Task 3 Report*, and a plant palette is provided in the *Task 5 Report*. Pockets of native vegetation, including willow, sycamore, and native emergent marsh, are present along the Los Angeles River levee, and in the south portion of the parcel. These would generally be left intact, and integrated with the proposed site development. Site development would include establishing shallow marsh, characterized by freshwater emergent wetlands in areas of shallow, permanent or semipermanent inundation; species may include bulrush, cattail, tall flatsedge, duckweed, sedge, rush, and others. Deep marsh would be characterized by freshwater, permanently inundated areas with water generally between 2 and 5 feet deep; species may include submerged plants including pondweed, water starwort, and waterweed.

Low riparian woodland would be developed in areas adjacent to permanent water with some soil saturation; these areas would support shrubby to woodland growth of willows, including Goodding's willow, sandbar willow, and narrow-leaf willow, as well as rush, sedge, tall flatsedge, and common plantain. This plant community would be planted in Alternative 2 in areas adjacent to permanent water as maintained by water control structures, typically on perimeter levees; it would also be established on islands within the permanently wet areas in the alternative. High riparian vegetation, consisting of Fremont's cottonwood, Mexican elderberry, mulefat, and other riparian species, would be planted in a mix with native scrub in upland areas. Native scrub, with species including dune buckwheat, California croton, coastal locoweed, goldenbush, and others, would be developed in upland areas of the Sixth Street Site as native dune scrub habitat.

TABLE 3-11
Proposed Acres of Habitat, Sixth Street Site Alternative 2

Zone	Acres of Habitat (Intact Existing)[1]
Channel	0.06
Deep Marsh	0.32
High Riparian	0.80
Low Riparian	1.10 (0.52)
Native Scrub	0.85

TABLE 3-11
Proposed Acres of Habitat, Sixth Street Site Alternative 2

Zone	Acres of Habitat (Intact Existing)[1]
Shallow Marsh	1.10 (0.07)
TOTAL	**4.23 (0.59)**

Notes:
1. Portions of existing native habitat would be left intact, with the remainder restored/enhanced; Acres of Habitat includes intact existing plus restored habitat. Existing habitat left intact indicated exclusively in parenthesis.

Recreational/Public Use Resources

Under Alternative 2, public use would be accommodated at a moderate level providing opportunities for passive use and elementary education. As in all the alternatives, a bicycle trail linkage would be provided across the site from the Seventh Street undercrossing to the LARIO trail. A LARIO rest area, with view bench and bike rack, would be constructed as a small fishing platform on the Los Angeles River side of the levee, south of the link/main trail intersection. On-site trails would include a boardwalk loop around the wetlands, with observation platforms equipped with interpretive signage and benches (see plan view, Figure 3-17; and conceptual section rendering, Figure 3-18). An elevated viewing platform would be constructed at the abandoned bridge over the Seventh Street undercrossing. Low barriers would line the boardwalk and on-grade trails to discourage wandering. The site would be attractive for local school field trips and as a "pocket park" for the neighborhood. Site access under Alternative 2 would be from the LARIO trail for trail users and via the Seventh Street undercrossing for maintenance vehicles, educational groups parking at Edison School, and/or park users venturing in from Cesar Chavez Park. Decorative pedestrian/bicycle entry gates would be located at the LARIO/link trail intersection on the west side of the site.

Treatment Capacity

Sixth Street Alternative 2 was not developed specifically as a treatment wetland; however, some water quality improvement to storm drain flow would be anticipated. The extent of this improvement was not analyzed, and in general would be limited by the small size of the wetland.

Cost Estimates

Total construction costs for this alternative are estimated at $1,201,775. Construction costs do not include additional data collection necessary for final design or further feasibility analysis, but do include estimates of final design, contract specifications, and construction management costs. Cost estimates are preliminary based on conceptual designs, and should only be used for planning-level purposes; they should be refined once final designs are developed. Total annual maintenance costs for this alternative are estimated at $63,606. Planning-level estimates of construction and maintenance costs by basin for Alternative 2 are provided in Table 3-12.

TABLE 3-12
Estimate of Construction and Maintenance Costs, Sixth Street Site Alternative 2

Basin	Estimated Costs[1,2] (2002 dollars)
Construction- Habitat Development	$660,212
Construction- Public Use	$541,564
TOTAL CONSTRUCTION	**$1,201,775**
Operation/Maintenance (per annum)	**$63,606**

Notes:
1. Costs do not include additional field testing or feasibility analysis.
2. Planning-level estimates only.

3.3.3 Alternative 3

Alternative Summary

This alternative would involve the creation of salt or brackish marsh habitat on the site where limited conflict with infrastructure makes this feasible, and development of native scrub habitats on the remainder of the site. This alternative would require opening a tidal connection to the Los Angeles River in the northern portion of the site, and grading the site down to tidal elevations. A seawall and/or crib wall would be placed at the perimeter of the graded area, primarily to increase the amount of marsh and provide an erosion resistant interface between the tidal marsh and adjacent upland areas. Existing infrastructure in conflict with the design, more specifically a portion of the storm drain, would be relocated. On portions of the site not graded for tidal marsh, non-native vegetation would be removed and native scrub vegetation would be planted. Public use would be developed to access the perimeter of the salt marsh area. Current City plans for a connection to the LARIO on the site would be implemented, and some facilities for a bicycle way-station would be developed.

This alternative would emphasize development of rare salt/brackish marsh habitat, and may integrate in the future with City proposals to create salt/brackish marsh on continuous parcels to the north of the Shoemaker Bridge. It is recognized that costs for this alternative may be prohibitive; however, the alternative is put forward for several reasons: (1) due to the rarity of intact salt/brackish marsh, and that even small areas of it are highly beneficial to wildlife, this is perceived as a biologically important alternative; (2) since the City already owns the land, and since land costs are high in this area, the cost of the wetland may be more economical than other sites even though size is small and infrastructure constraints are limiting; and (3), cost estimates and design for this site may be transferable to other sites if this site is never developed as salt marsh.

Physical Development

The proposed grading for Alternative 3 involves lowering the portion of the site north of the pump station down to tidal elevations. Infrastructure constraints are more extensive south of the pump station, and for this reason the marsh was not extended in this direction.

Grading plans and cross-sections of the alternative were provided in the *Task 5 Report.* Optimal elevations for low salt marsh are approximately 4 to 7 feet above Mean Low Lower Water (MLLW), with brackish or high salt marsh species occurring at elevations above this. The closest estimate of MLLW referenced to known site elevations would be –2.84 feet mean sea level (National Geodetic Vertical Datum [NGVD]–29 [msl]). To accurately determine this however, a tidal study at the site would be necessary (see discussion in *Task 3 Report*), and this should be conducted prior to developing final design for the site. Based on this elevation of MLLW, planting elevations should be from 1.16 feet msl to 4.16 feet msl, with high salt marsh or brackish species above this elevation.

Based on these elevations, the proposed site grade for Alternative 3 for the salt marsh ranges from less than –1.0 to just above 6.0 feet msl. This provides area of permanent water, tidally exposed mudflat, and a range of tidal marsh elevations. Grades within the tidal marsh would typically be about 15 or 20:1. This design presumes salinity levels in the Los Angeles River at Sixth Street Site are appropriate to support salt marsh habitat.

Soil types at subsurface grades are unknown, and may include substantial non-native fill including aggregate materials, urban debris, contaminated soils, or soils with chemical imbalances. For this reason, subsurface soil and geotechnical investigations are recommended before proceeding with final designs.

Utilities and Infrastructure

Additional infrastructure would be required to implement this alternative. A tidal connection with the Los Angeles River could be accomplished through a small reinforced concrete box (RCB), which would provide a culvert that would allow flows to migrate based on the tidal influences in the river, but would have a remotely operated slide gate to allow the site to be protected from flooding during storm events when flows in the river increase. The RCB would have an invert elevation of 1 foot below MSL. The connection would be approximately 90 feet in length. Conceptual plans for this are presented in the *Task 5 Report*.

The Sixth Street Site marsh proposed in Alternative 3 would require regrading and removal of as much as eleven feet of soil; the reconfiguration of the site would require the installation of crib and seawalls to maximize the available land for marsh development. The seawalls would be approximately four feet in height with the cribwalls providing the framework for the remainder of the wall (from 2 to 6 feet high). The wall system for the site would be configured with the seawall located along the perimeter of the marsh; at the top of the seawall there would be a slight setback, and the cribwall would begin.

Trash removal at the Sixth Street Site would be accomplished one or more of the following: (1) a floating trash barrier in the Los Angeles River; (2) trash removal mechanism on both sides of the entrance to the marsh; and (3) a trash rack installed within the RCB.

There are significant utility and/or infrastructure conflicts for developing Alternative 3 on the Sixth Street Site, and in fact, infrastructure/utility conflicts significantly constrain the size of potential marsh. Potential conflicts include maintaining adequate access to the existing Sixth Street Pump Station, access to the utility bridge across the Los Angeles River, and maintenance of underground pipelines and utilities, including the storm drain pipeline that supplies the pump station, and the discharge pipeline from the pump station to the Los Angeles River.

The Alternative 3 design proposes maintenance access to the pump station from the existing unused on-ramp onto Shoreline Drive. Access to the utility bridge would be handled via the ramp to the LARIO Trail located at the Sixth Street Site, and incorporated into the bike trail improvements at this location. The final conflicts with the underground storm drain pipelines are handled by (1), locating the below grade wetland to the north of the pump station to avoid the discharge line, and (2), rerouting the supply pipeline to a point east of its existing location along the roadway structures at the east of the site.

Water Supply

The Los Angeles River near the Sixth Street Site has a natural bottom with riprap side slopes; the flow in the river at the Sixth Street Site is tidally influenced and cannot be measured. Salinity or other water quality parameters are not available at the Sixth Street Site; however, this would be important in developing final planting palettes and design for tidal habitat on the site, and a seasonal range of this data should be collected at the site prior to proceeding to final design. Hydric regime in tidal systems is established by wetland grade elevations relative to tide levels; as such, no water budget has been developed for the tidal marsh or is necessary. As indicated above, final design of the site to insure appropriate tidal inundation levels would rely on information from a tidal study at the site.

Basin Operations

No alteration to existing pump station operation is anticipated under this alternative. The surface areas at the Sixth Street Site are not currently used for flood storage, so storage capacity is not an issue. However, the lowered elevation of the tidal marsh may be inundated from storm flows from the Los Angeles River during flood stages. The site could potentially contain storm surges, assuming perimeter infrastructure is designed to accommodate this, or a storm flap could be installed on the tidal inlet, with automated control during high Los Angeles River water elevations; this is proposed for this alternative.

Biological Resources

Vegetation communities proposed for the Sixth Street Site under Alternative 3 are presented in Figure 3-19. A cross-section rendering of typical plant communities and wetland elevations in the salt marsh is provided in Figure 3-20. The proposed acreage of new or enhanced habitat under this planting plan is provided in Table 3-13. A more complete description of these communities is provided in the *Task 3 Report*, and a plant palette is provided in the *Task 5 Report*. Because salinity levels are presently unknown at the Los Angeles River at the Sixth Street Site, it is not known whether the site could support traditional salt marsh species or rather species adapted to more brackish salinity. Prior to developing final plant palettes and habitat and grading design for the site, salinity should be measured. This would require periodic sampling over a year to sample annual variation. Anticipated species in the salt/brackish marsh may include estuary sea-blite, pickleweed, Coulter's goldfields, toad rush, and alkali weed. Along the banks of tidally influenced rivers, salinity gradients determine plant community constituents and vary from species tolerant of salt water (polyhaline, salinities 18 to 30 ppt) along the coast to species adapted to brackish water (mixohaline, salinities 0.5 to 30 ppt) upstream. Development of this community at the Sixth Street Site would be limited to areas of tidal inundation, generally between 1.28 and 3.11 meters (4.2 and 10.2 feet) or more above MLLW.

In other upland areas of the site, a native scrub or back dune scrub community would be developed; species may include dune buckwheat, California croton, coastal locoweed, goldenbush, and others.

TABLE 3-13
Proposed Acres of Habitat, Sixth Street Site Alternative 3

Zone	Acres of Habitat (Intact Existing)[1]
High Salt Marsh	0.18
Permanent Tidal Water	0.03
Salt Marsh	0.52
Native Dune Scrub	2.21
Fresh Wetland/Riparian	0.61 (0.61)
Tidally Exposed Mudflat	0.12
TOTAL	**3.67 (0.61)**

Notes:
1. Portions of existing native habitat would be left intact, with the remainder restored/enhanced; Acres of Habitat includes intact existing plus restored habitat. Existing habitat left intact indicated exclusively in parenthesis.

Recreational/Public Use Resources

Under Alternative 3, public use would be accommodated at a relatively high level, providing enhanced opportunities for passive use and elementary education. The site would be attractive for local and non-local school field trips, as a LARIO trail highlight, and as an interesting destination for the general public. See Figure 3-21 for the plan view. As in all the alternatives, a bicycle trail linkage would be provided across the site from the Seventh Street undercrossing to the LARIO trail. A direct access from the LARIO trail would be constructed to reach a salt marsh overlook platform north of the link/main trail intersection. To the south, a separate, moderately sized fishing platform would developed as a LARIO rest area located on the Los Angeles River side of the LARIO trail. The on-site trail system would include an on-grade trail up to the salt marsh edge, with observation platforms large enough to accommodate school groups and equipped with interpretive signage and benches. The salt marsh trail would be lined with railing-height barriers user safety at the edge of the crib wall. A separate on-grade loop trail would take school groups through the scrub vegetation in the southern portion of the site, where they would find an additional observation platform and signage. The scrub trail would be lined with low barriers to more subtly discourage wandering. Individual benches would be placed in sunny, shady and scenic spots to accommodate the general public. Due to the increased activity level, a restroom—possibly as a pumpable or composting unit—would be useful as an optional additional feature, most likely located at the intersection of the on-site and link trails.

Site access under Alternative 3 would be from the LARIO trail for trail users and via the Seventh Street undercrossing for maintenance vehicles, educational groups parking at Edison School, and/or park users venturing in from Cesar Chavez Park. Decorative

pedestrian/bicycle entry gates would be located at both the Seventh Street undercrossing east of the site, and at the LARIO/link trail intersection on the west side of the site. The walls and steep paved banks east of the Seventh Street undercrossing would provide opportunities for interpretive panel exhibits, and could be further decorated with ecologically-themed murals. Refer to Figure 3-22 for a cross-sectional view of proposed improvements. The increased activity level, gates, signage and trailside barriers would help discourage improper usage.

Cost Estimates

Total construction costs for this alternative are estimated at $2,619,640. Planning-level estimates of construction and maintenance costs by basin for Alternative 3 are provided in Table 3-14. Construction costs do not include additional data collection necessary for final design or further feasibility analysis, but do include estimates of final design, contract specifications, and construction management costs. Total annual maintenance costs for this alternative are estimated at $70,248.

TABLE 3-14
Estimate of Construction and Maintenance Costs, Sixth Street Site Alternative 3

Basin	Estimated Costs[1,2] (2002 dollars)
Construction- Habitat Development	$2,101,405
Construction- Public Use	$518,235
TOTAL CONSTRUCTION	**$2,619,640**
Operation/Maintenance (per annum)	**$70,248**

Notes:
1. Costs do not include additional field testing or feasibility analysis.
2. Planning-level estimates only.

3.4 DeForest Site Alternative Review

3.4.1 Alternative Summary

The three alternatives provide a range of site development from enhancing existing conditions under Alternative 1, to a moderate site development with water treatment under Alternative 2, to full site development with a large, steady water source under Alternative 3. All three alternatives would provide habitat enhancement, including replacing non-native communities with native communities; Alternatives 2 and 3 would involve more emphasis on wetland communities. All three alternatives would involve developing a visitor center and enhancement of public use potential, while Alternatives 2 and 3 would offer progressively more extensive user opportunities. Alternative 2 would involve wetland designs with specific treatment emphasis. While Alternative 3 would offer treatment potential, the wetland design would emphasize habitat. Alternatives 2 and 3 offer progressively greater flood storage capacity, while Alternative 1 preserves existing capacity. Costs are progressively greater from Alternative 1 to 3.

3.4.2 Physical Development

Table 3-15 provides a summary of the total amount of cut and fill required in site grading. The large amount of cut and export associated with Alternative 3 is associated with the large reduction from the existing grade to bring the South Basin to a lower grade to receive gravity flow from the Central Basin.

TABLE 3-15
Preliminary Cut and Fill Volume Estimates, DeForest Site Alternatives

Alternative	Soil Volume (cubic yards)		
	Cut	Fill	Total Export (Cut minus Fill)
Alternative 1	0	0	**0**
Alternative 2	25,598	539	**25,059**
Alternative 3	70,943	556	**70,387**

3.4.3 Utilities and Infrastructure

Table 3-16 provides a summary of utility and infrastructure conflicts for the DeForest Site alternatives. In general, there are no fatal conflicts, and most can be resolved with reasonable costs.

TABLE 3-16
Utility and Infrastructure Conflicts, DeForest Site Alternatives

Alternative	Utility/Infrastructure Conflicts	Resolve
Alternative 1	None	None required
Alternative 2	1. 33-inch and 42-inch concrete-encased sewer line in Central Basin	1. Protect and encase, and use under water control structure
	2. Increased water flow through North Long Beach Boulevard overpass alongside bridge piers	2. Armor bridge piers with rip-rap
Alternative 3	1. 33-inch and 42-inch concrete-encased sewer line in Central Basin	1. Protect and encase, and use under water control structure
	2. Increased water flow through North Long Beach Boulevard overpass alongside bridge piers	2. Armor bridge piers with rip-rap
	3. Flow-through from Central to South Basin would pass by Market Street Pump Station, and grade would be lowered south of station	3. Provide siphons for flow beneath pump station, and create berms to encapsulate pump station
	4. Flow through to Dominguez Gap would require additional infrastructure beneath Del Amo Boulevard	4. Inlet and outlet structures and a connection pipeline would be installed

3.4.3.1 Water Supply

Table 3-17 provides a summary of the proposed water regime for the three alternatives, and the approximate acres of wetland that result under the alternative. The Alternative 2 quantity is determined by the treatment capacity of the wetland versus the actual supply amount, which could be greater from the Los Angeles River. The Alternative 3 is determined more by the amount of water that must be disposed of from I-105 than by the water requirements of the wetland, which would be considerably less.

TABLE 3-17
Water Supply, Low-flow Output, and Acres of Wetland Supported, DeForest Site Alternatives

	Wetland Parameters		
Alternative	**Augmented Supply (cfs)**	**Low-flow Output (cfs)**	**~ Acres of Wetland**
Alternative 1	None	Existing	2.43
Alternative 2	Up to 0.50	0.27	5.10
Alternative 3	3.10	2.80	8.49

3.4.3.2 Basin Operations

Both Alternatives 2 and 3 provide an increase in flood storage capacity, as indicated in Table 3-18, while Alternative 1 leaves this unchanged. The increased storage capacity is calculated based on mean water levels in the wetland. While increased flood storage would occur under Alternative 3, the drainage of the basin would be altered, with some flood flows bypassing the MSPS and flowing into the South Basin which would be down-gradient of the MSPS under the alternative. This alteration in flow would have to be managed from the Dominguez Gap Pump Station, where the flows would eventually end up. Alternatively they can be left in the South Basin to recede slowly.

TABLE 3-18
Estimated Change in Flood Storage Capacity, DeForest Basin, DeForest Site Alternatives

Alternative	**Change in Storage Capacity (acre-feet)**
Alternative 1	0.0
Alternative 2	+9.168
Alternative 3	+31.641

3.4.3.3 Biological Resources

Table 3-19 provides a comparison of habitat created under the three DeForest Site alternatives. All alternatives create approximately the same amount of habitat, varying only slightly because of differing amounts of native vegetation preserved or used for roads or infrastructure. Alternative 1 preserves the existing small marsh and wet riparian area, which totals about 2.43 acres (2.38 acres in the North Basin, and 0.05 acres at the MSPS). In addition to preserving portions of this native marsh, Alternatives 2 and 3 create additional marsh. Alternative 2 would support 4.67 acres of perennial wet marsh, and an additional 0.43 acres of seasonal marsh. In general, the perennial wet marsh is predominantly designed for treatment capacity, and consists of alternating shallow and deep zones, with common emergent plant species including bulrush and cattail. Alternative 3 would support 8.49 acres of perennial wet area, including more diversity in habitat such as open water and seasonal mudflats (managed). In addition, the habitat contains more islands, including nesting islands for ground nesting birds (managed).

In areas not perennially inundated, all alternatives offer a mix of low riparian vegetation, high riparian vegetation, and native scrub. All the alternatives propose enhancement of the existing woodland in the North Basin. Alternative 1 emphasizes native scrub in the Central and South Basins, and proposes planting this exclusively except where there is existing native vegetation. Alternative 2 emphasizes a mix of native scrub and high riparian in the Central and South Basin upland areas, while Alternative 3 tends to favor native scrub over high riparian habitats in open upland areas in the Central and South Basins.

TABLE 3-19
Proposed Acres of Habitat by Alternative, DeForest Site

	Acres of Habitat[1]		
Zone	**Alternative 1**	**Alternative 2**	**Alternative 3**
Deep Marsh	---	0.84	1.54
High Riparian	6.39	11.97	7.38
Low Riparian	1.69[2]	4.37	6.04
Nesting Island	---	---	0.12
Open Water	---	---	1.03
Native Scrub	25.79	13.31	13.37
Seasonal Mudflat	---	---	0.38
Shallow Marsh	1.69[2]	3.83	5.54
Temporary Pool	---	0.43	---
TOTAL	**35.56**	**34.75**	**35.39**

Notes:
1. Includes restored and existing native vegetation which will be left intact.
2. Estimated as portion of Low Riparian/Shallow Marsh.

3.4.4 Recreation/Public Use Resources

Table 3-20 presents a qualitative summary of the relative impacts and benefits of the three alternatives presented for public use of the DeForest site. In general, there are tradeoffs between providing opportunities for a higher level of public use and the environmental and financial price that would be paid. Physical and operational strategies can be deployed to help mitigate the impacts, as discussed in the Constraints Analysis of the *Task 3 Report* and depicted in the discussion of each alternative concept. Final determination of the user facilities to be provided and the selection of appropriate mitigation strategies would likely become a technical and political "mixing and matching" exercise during a future Master Planning process.

In terms of impact on the environment, accommodating more people generally produces more disturbance to wildlife, so Alternative 1 would have less impact than Alternative 3. However, Alternative 3 includes more physical barriers to unsupervised wandering, so long-term impacts on vegetation are likely to be less.

With respect to impacts on residents, the higher use level in Alternative 3 would produce a greater likelihood of noise and privacy impacts. Alternative 3 also would have the highest impact during the construction period (simply because more work would need to be done over a longer period); and into the future due to the ongoing need to park a higher number of vehicles. However, the waterscape and revegetation plans for Alternatives 2 and 3 would represent a significant scenic enhancement over the current condition.

The scenic enhancements in Alternatives 2 and 3 also offer a greater variety of aesthetic and educational experiences for the users of the DeForest site, compared to Alternative 1. Attracting more users implies more opportunity for generating revenue, both on-site in the Visitor Center gift shop and off-site at local commercial establishments, if users are drawn from outside the immediate neighborhood. However, sales and tax revenue is unlikely to offset the cost of maintaining and operating the public use facilities and programs.

3.4.5 Water Quality Improvement

Wetlands in each alternative provide some water quality improvement. Alternative 2 is the only alternative that specifically emphasizes treatment, and could treat enough Los Angeles River water to Title 22 standards to provide between 0.27 and 0.60 cfs to a recycled system during low-flow months. Alternative 3 if designed as a treatment wetland, could provide a greater flow, up to double this amount.

3.4.6 Cost Estimates

Table 3-21 provides a comparison of cost estimates for the three alternatives. As indicated, Alternative 3 is the most expensive, with costs driven up by the extensive grading necessary in the South Basin, the higher acreage of habitat requiring more costly restoration, and more extensive public use facilities. Alternative 2 is intermediate, but the difference is moderated by the costs associated with grading for treatment purposes in the North and Central Basins, and infrastructure associated with the vertical-flow cell. Also, there are additional maintenance costs in Alternative 2 for the treatment wetland and vertical flow cell. Alternative 1 is the least costly. However, maintenance costs on keeping invasive exotic species out of native scrub areas are likely to be higher than wetland or riparian habitats.

TABLE 3-20
Evaluation of Public Use Resources
DeForest Site

Effects of Public Use	Alternative 1	Alternative 2	Alternative 3
IMPACTS ON WILDLIFE/HABITATS			
Noise	●	◗	○
Light	●	◗	○
Vegetative Trampling	○	◗	●
Compaction/Erosion	○	◗	●
IMPACTS ON LOCAL RESIDENTS			
Privacy/Security	●	◗	○
Noise	●	◗	○
Visual Impacts	◗	○	◗
Parking	●	◗	○
Construction Period Impacts	●	◗	○
SOCIO-ECONOMIC IMPACTS			
Variety of User Experience	○	◗	●
Total Number of Users	○	◗	●
Capital Costs	●	◗	○
Facility Maintenance Costs	●	◗	○
Program operational costs	●	◗	○
Revenue Opportunities	○	◗	●

● Most Benefit or Least Impact ◗ Moderate/Mixed Benefits & Impacts ○ Least Benefit or Most Impact

TABLE 3-21
Estimated Construction and Maintenance Costs by Alternative, DeForest Site

Cost	Estimated Costs[1,2] (2002 dollars)		
	Alternative 1	**Alternative 2**	**Alternative 3**
Construction- Habitat Development	$1,187,959	$4,542,341	$8,006,668
Construction- Public Use	$1,856,980	$2,603,339	$3,630,643
TOTAL CONSTRUCTION	**$3,044,940**	**$7,145,680**	**$11,637,311**
Operation/Maintenance (per annum)	**$143,090**	**$228,552**	**$225,959**

Notes:
1. Costs do not include monitoring, additional field testing or feasibility analysis.
2. Planning-level estimates only.

3.5 Sixth Street Site Alternative Review

3.5.1 Alternative Summary

The three alternatives provide a range of site development from enhancing existing conditions under Alternative 1, to a moderate site development with a fresh marsh under Alternative 2, to salt marsh development with tidal influx under Alternative 3. All three alternatives would provide habitat enhancement, including replacing non-native communities with native communities; Alternatives 2 and 3 would involve more emphasis on wetland communities, including fresh marsh and salt marsh respectively. All three alternatives would involve enhancement of public use potential, while Alternatives 2 and 3 would offer progressively more extensive user opportunities. Costs are progressively greater from Alternative 1 to 3.

3.5.2 Physical Development

Table 3-22 provides a summary of the total amount of cut and fill required in site grading. The large amount of cut and export associated with Alternative 3 is associated with the large reduction from the existing grade to bring the site to elevations that could receive tidal flows from the Los Angeles River.

TABLE 3-22
Preliminary Cut and Fill Volume Estimates, Sixth Street Site Alternatives

Basin	Soil Volume (cubic yards)		
	Cut	**Fill**	**Total Export (Cut minus Fill)**
Alternative 1	0	0	**0**
Alternative 2	2,573	1,242	**1,331**
Alternative 3	11,100	0	**11,100**

3.5.3 Utilities and Infrastructure

Table 3-23 provides a summary of utility and infrastructure conflicts for the Sixth Street Site alternatives. In general, there are no fatal conflicts, but conflicts do exist that limit the area of site development, particularly in Alternative 3 for the salt marsh.

TABLE 3-23
Utility and Infrastructure Conflicts, Sixth Street Site Alternatives

Alternative	Utility/Infrastructure Conflicts	Resolve
Alternative 1	None	None required
Alternative 2	1. Access to Sixth Street Pump Station may be restricted by marsh	1. Access can be maintained by the existing unused on-ramp to Shoreline Drive
	2. Access to the utility bridge across the Los Angeles River may be restricted by marsh	2. Designs would require that access continue to the LARIO trail onramp which accesses the utility bridge
	3. The storm drain north of the pump station lies beneath the proposed wetland	3. Designs would require protecting the storm drain
	4. Bridge footings are adjacent to the proposed wetland	4. A minimum distance of 15' would be maintained between the wetland and footings
Alternative 3	1. Access to Sixth Street Pump Station may be restricted by salt marsh	1. Access can be maintained by the existing unused on-ramp to Shoreline Drive
	2. Access to the utility bridge across the Los Angeles River may be restricted by site development	2. Designs would require that access continue to the LARIO trail onramp which accesses the utility bridge
	3. The storm drain north of the pump station lies beneath the proposed salt marsh	3. Designs would require relocating the storm drain to a new position
	4. A permanent tidal connection with the Los Angeles River would be required, with flood potential	4. The connection would require a tide gate to stop inflow during flood events
	5. Bridge footings are adjacent to the proposed wetland	5. A minimum distance of 15' would be maintained between the wetland and footings

3.5.4 Water Supply

The water supply varies between alternatives, with Alternative 1 not requiring any water supply, Alternative 2 requiring some stormwater flow, up to about 0.1 cfs, and Alternative 3 relying on a tidal connection with the Los Angeles River. In this case water supply is limited by the marsh elevation, not the supply itself.

3.5.5 Basin Operations

Basin operations (pump station) would remain unchanged in Alternatives 1 and 2, except that a limited amount of storm flow would be diverted to the site under Alternative 2. Under Alternative 3, basin operations would not necessarily be altered, but stormwater management would be required for the open tidal connection with the Los Angeles River.

3.5.6 Biological Resources

Table 3-24 provides a comparison of habitat provided under the three Sixth Street Site alternatives. All alternatives provide approximately the same amount of habitat; Alternative 3 has less habitat because of infrastructure requirements associated with the salt marsh. Alternative 1 creates predominantly native scrub on the site, except where existing native vegetation occurs already. Alternative 2 creates 1.42 acres of perennial wet freshwater marsh, with adjacent riparian vegetation consistent with that proposed for the DeForest Site. Upland areas emphasize native scrub mosaiced with low and high riparian habitats. Alternative 3 creates salt marsh habitat, with limited gradation within the habitat from sub-tidal areas to intra-tidal mudflats, to salt marsh. On the south portion of the site, native scrub is proposed; this represents areas with substantial infrastructure conflict that would preclude the possibility of excavation for a salt marsh.

TABLE 3-24
Proposed Acres of Habitat by Alternative, Sixth Street Site

	Acres of Habitat[1]		
Zone	**Alternative 1**	**Alternative 2**	**Alternative 3**
High Salt Marsh	---	---	0.18
Permanent Tidal Water	---	---	0.03
Salt Marsh	---	---	0.52
Tidally Exposed Mudflat	---	---	0.12
Deep Marsh	---	0.32	---
High Riparian	---	0.80	---
Low Riparian	0.52	1.10	0.52
Channel	---	0.06	---
Native Scrub	3.58	0.85	2.21
Shallow Marsh	0.09	1.10	0.09
TOTAL	**4.19**	**4.23**	**3.67**

Notes:
1. Includes acres of restored habitat and existing native vegetation which will be left intact.

3.5.7 Recreation/Public Use Resources

Table 3-25 presents a qualitative summary of the relative impacts and benefits of the three alternatives presented for public use of the Sixth Street site. In general, there are tradeoffs between providing opportunities for a higher level of public use and the environmental and financial price that would be paid. Physical and operational strategies can be deployed to help mitigate the impacts, as discussed in the Constraints Analysis of the *Task 3 Report* and depicted in the discussion of each alternative concept. Final determination of the user facilities to be provided and the selection of appropriate mitigation strategies would likely become a technical and political "mixing and matching" exercise during a future Master Planning process.

In terms of impact on the environment, accommodating more people generally produces more disturbance to wildlife, so Alternative 1 would have less impact than Alternative 3. However, Alternative 3 includes more physical barriers to unsupervised wandering, so long-term impacts on vegetation are likely to be less.

With respect to impacts on residents, there would be little noise or privacy impact in any of the alternatives, simply because the site is so isolated and separated from residences by high-traffic and elevated roadways. Visually, any of the alternatives would represent an improvement over the current condition, but again there is little direct impact to residences. Alternative 3 would have a higher impact during the construction period, simply because more work would need to be done over a longer period. The higher number of users anticipated under Alternatives 2 and 3 would generate an ongoing need to park a higher number of vehicles, which may impact the neighborhoods on a permanent but intermittent basis.

The scenic enhancements in alternatives 2 and 3 also offer a greater variety of aesthetic and educational experiences for the users of the Sixth Street site, compared to Alternative 1. Local off-site commercial establishments may benefit financially if users are drawn from outside the immediate neighborhood. However, sales tax revenue is unlikely to offset the cost of maintaining and operating the public use facilities.

3.5.8 Water Quality Improvement

Treatment wetland capacity was not evaluated under any of the alternatives for Sixth Street Site. However, Alternative 2 is likely to provide some water quality improvement.

3.5.9 Cost Estimates

Table 3-26 provides a comparison of cost estimates for the three alternatives. As indicated, Alternative 3 is the most expensive, with costs driven up by the extensive grading necessary for the salt marsh and associated infrastructure. Alternative 2 is intermediate, but the difference is moderated by the costs associated with habitat creation of more costly wetland and riparian cover. Alternative 1 is the least costly. In all alternatives, maintenance costs on keeping invasive exotic species out of native scrub areas are likely to be higher than costs to keep exotics out of wetland or riparian habitats.

TABLE 3-25
Evaluation of Public Use Resources
Sixth Street Site

Effects of Public Use	Alternative 1	Alternative 2	Alternative 3
IMPACTS ON WILDLIFE/HABITATS			
Noise	●	◗	○
Light	●	◗	○
Vegetative Trampling	○	◗	●
Compaction/Erosion	○	◗	●
IMPACTS ON LOCAL RESIDENTS			
Privacy/Security	●	●	●
Noise	●	●	●
Visual Impacts	◗	●	●
Parking	●	◗	○
Construction Period Impacts	●	◗	○
SOCIO-ECONOMIC IMPACTS			
Variety of User Experience	○	◗	●
Total Number of Users	○	◗	●
Capital Costs	●	◗	○
Facility Maintenance Costs	●	◗	○
Program Operational Costs	●	◗	○
Revenue Opportunities	○	○	○

● Most Benefit or Least Impact ◗ Moderate/Mixed Benefits & Impacts ○ Least Benefit or Most Impact

TABLE 3-26
Estimated Construction and Maintenance Costs by Alternative, Sixth Street Site

Cost	Estimated Costs[1,2] (2002 dollars)		
	Alternative 1	**Alternative 2**	**Alternative 3**
Construction- Habitat Development	$116,024	$660,212	$2,101,405
Construction- Public Use	$169,145	$541,564	$518,235
TOTAL CONSTRUCTION	**$285,168**	**$1,201,775**	**$2,619,640**
Operation/Maintenance (per annum)	**$25,880**	**$63,606**	**$70,248**

Notes:
1. Costs do not include monitoring, additional field testing or feasibility analysis.
2. Planning-level estimates only.

Figures – Section 3.0

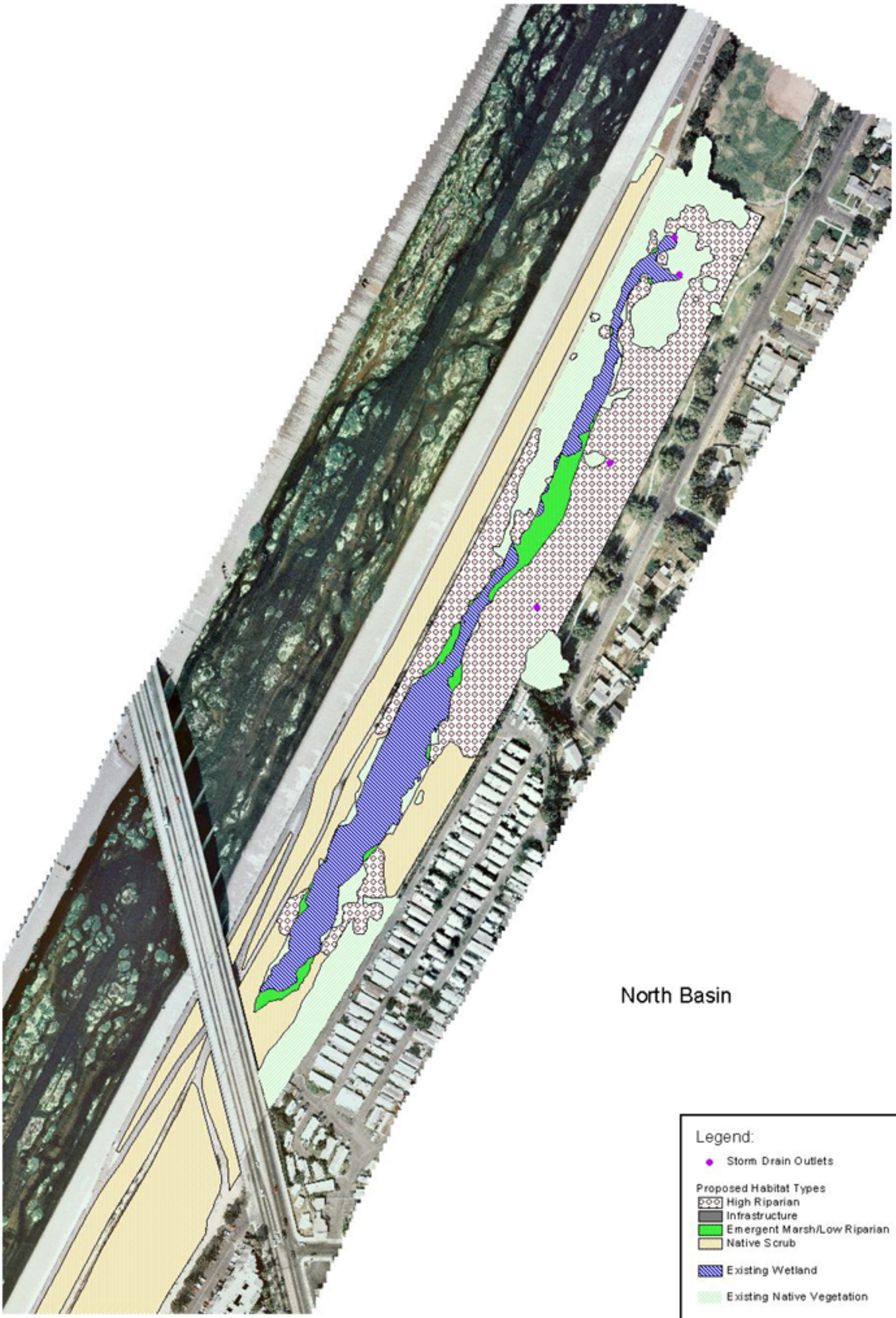

Figure 3-1a
Proposed Habitat Types
DeForest Site Alternative 1
Wetland Feasibility Study

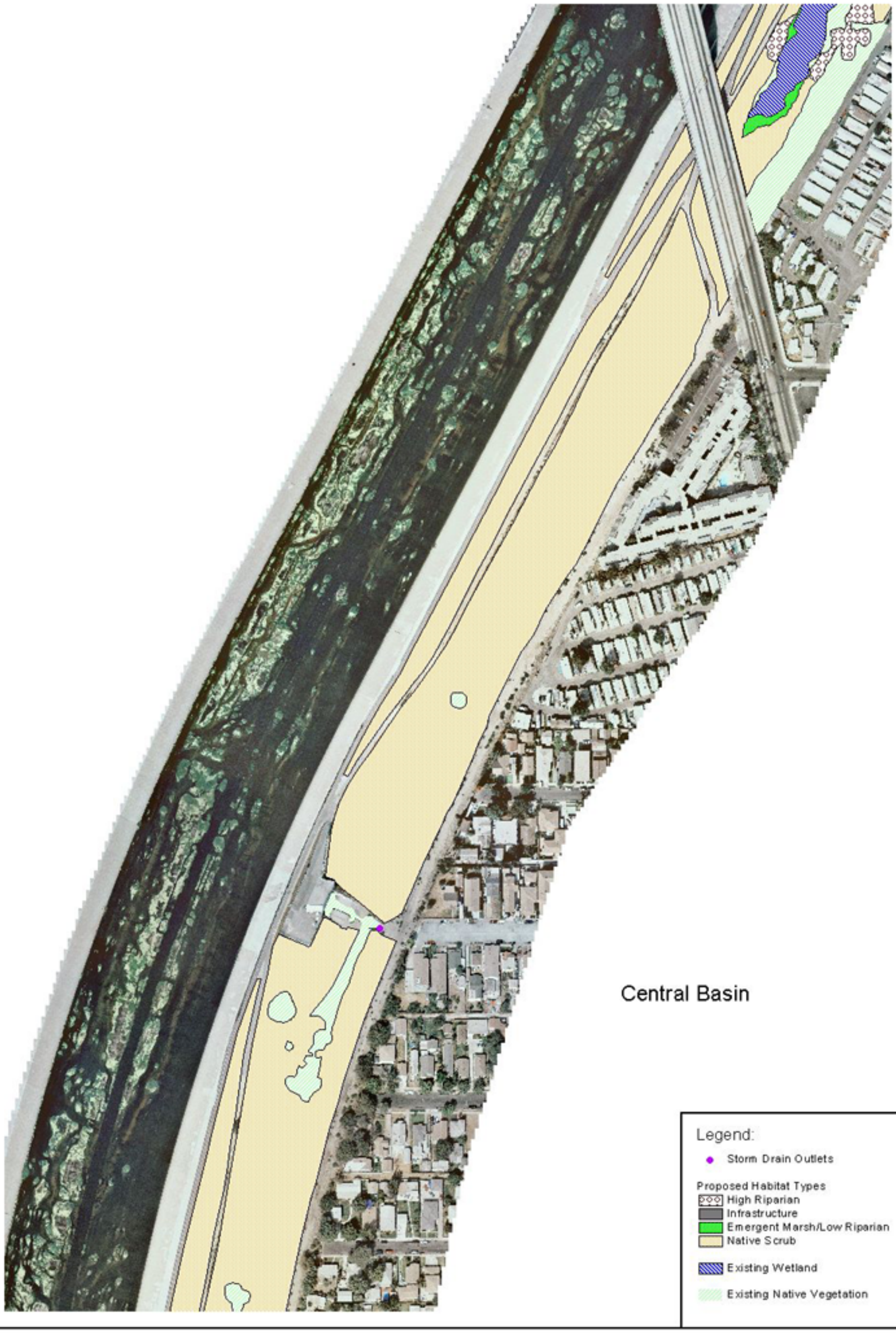

Figure 3-1b
Proposed Habitat Types
DeForest Site Alternative 1
Wetland Feasibility Study

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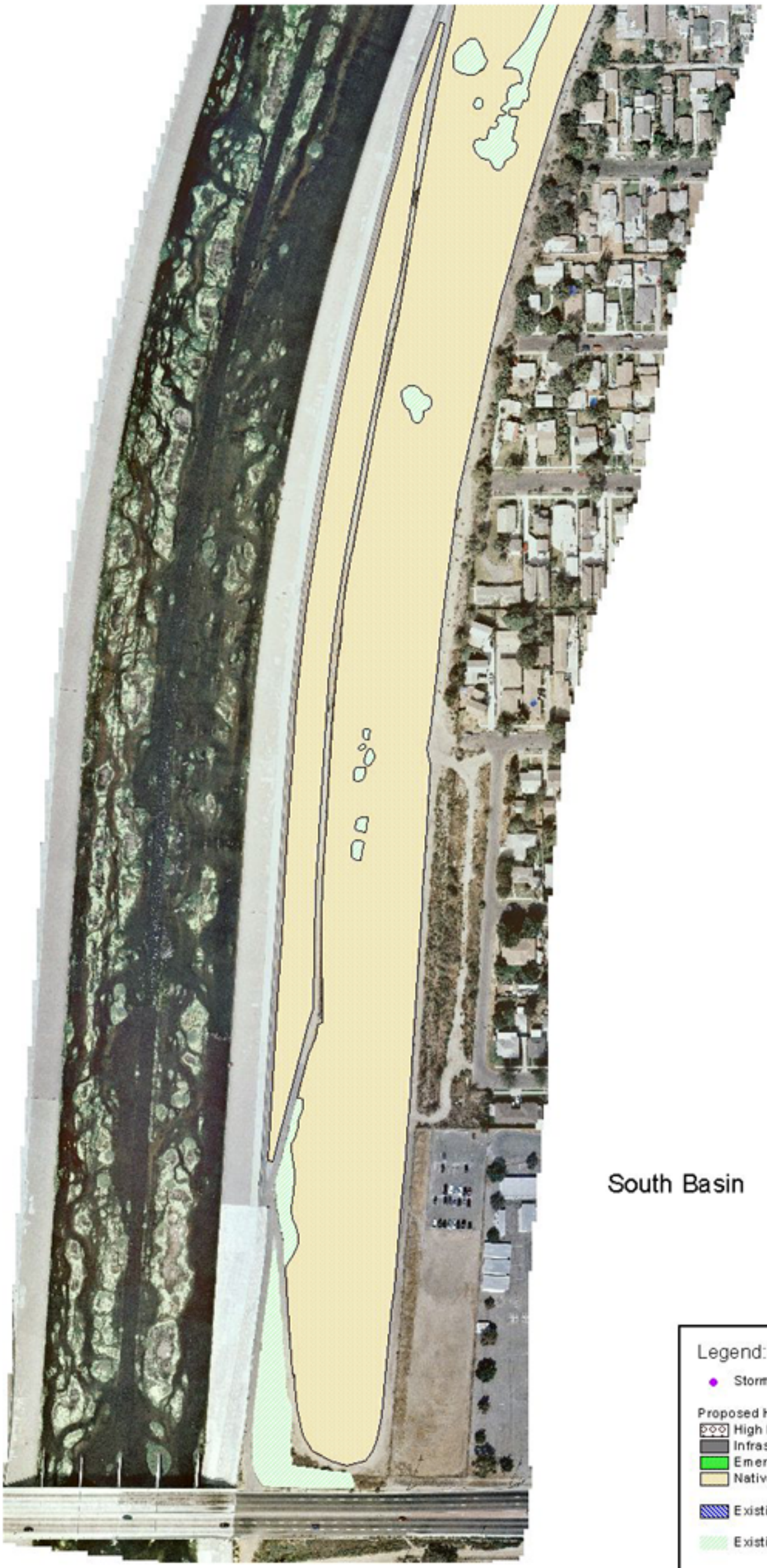

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Figure 3-1c
Proposed Habitat Types
DeForest Site Alternative 1
Wetland Feasibility Study

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North Basin

Legend:

Visitor Center

Public Use Features- Points

Alarms/Callboxes

Benches/Seating

Fence Design

Gates

Signage (Orientation, Interpretive)

Signage Controls (Rules)

Trail Edge Barriers

Public Use Features- Linear

Decomposed Granite Path

Existing Fencing

Fire/Maintenance Road

Paved Trail

Raised Boardwalk- Narrow

Proposed Habitat Types

Infrastructure

Wetland

Upland Scrub/Woodland

Existing Wetland

Existing Native Vegetation

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Figure 3-2
Proposed Public Use Plan
DeForest Site Alternative 1
Wetland Feasibility Study

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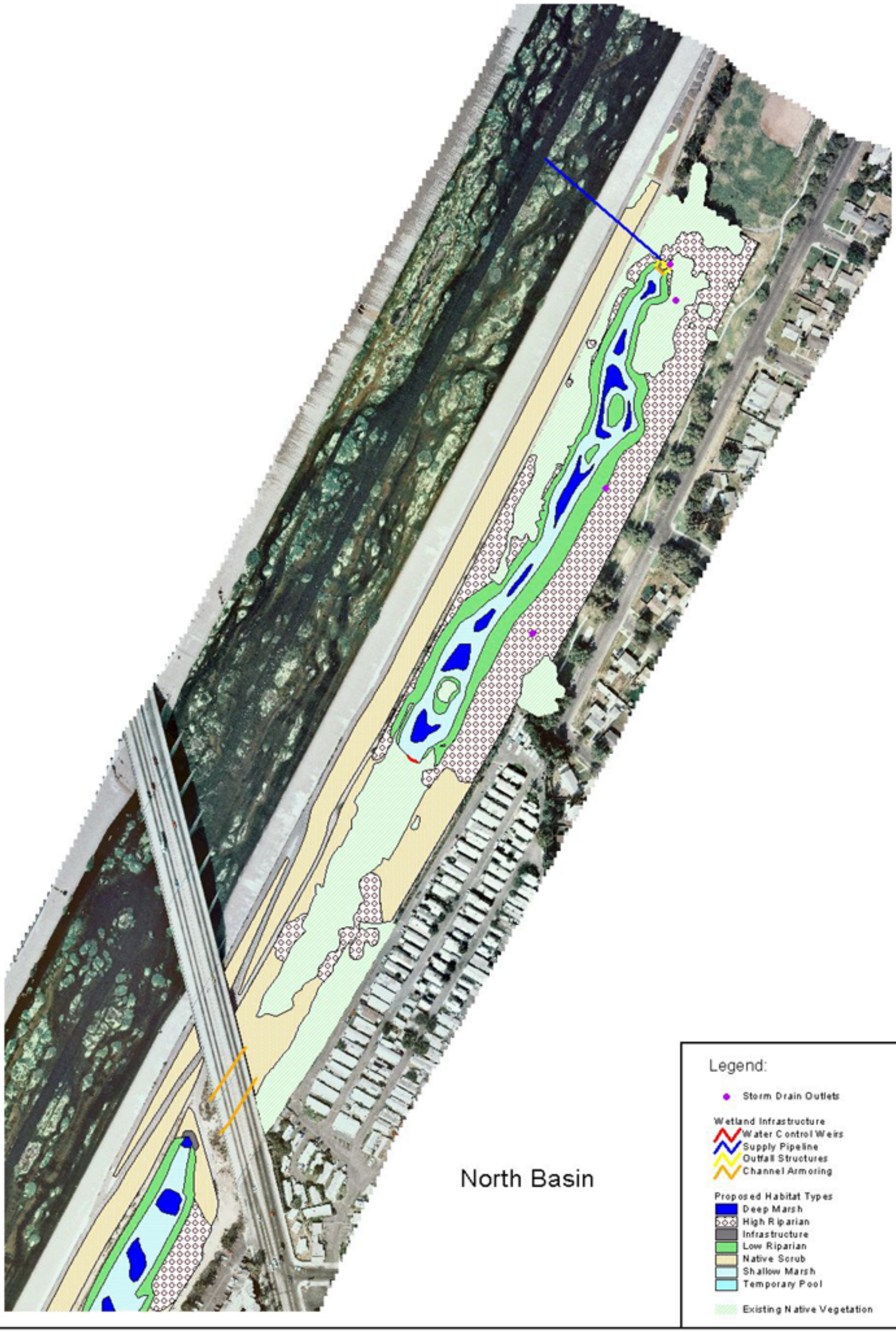

Figure 3-4a
Proposed Habitat Types
DeForest Site Alternative 2
Wetland Feasibility Study

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Figure 3-4b
Proposed Habitat Types
DeForest Site Alternative 2
Wetland Feasibility Study

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South Basin

Legend:

- Storm Drain Outlets

Wetland Infrastructure
- Water Control Weirs
- Supply Pipeline
- Outfall Structures
- Channel Armoring

Proposed Habitat Types
- Deep Marsh
- High Riparian
- Infrastructure
- Low Riparian
- Native Scrub
- Shallow Marsh
- Temporary Pool

Existing Native Vegetation

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Figure 3-4c
Proposed Habitat Types
DeForest Site Alternative 2
Wetland Feasibility Study

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High Riparian (>6')*	Low Riparian (0' to 6')	Shallow Marsh (0' to -2')	Deep Marsh (-2' to -3')
Fremont Cottonwood	Willow Sp.	Bulrush Sp.	Pondweed
Box Elder	Sedges	Spike-Rush	Watercress
Mulefat	Mugwort	Arrowhead	Duckweed
Coyote Brush	Rush	Cattail	Water Starwort
	Mulefat		

*Elevations based on mean water surface

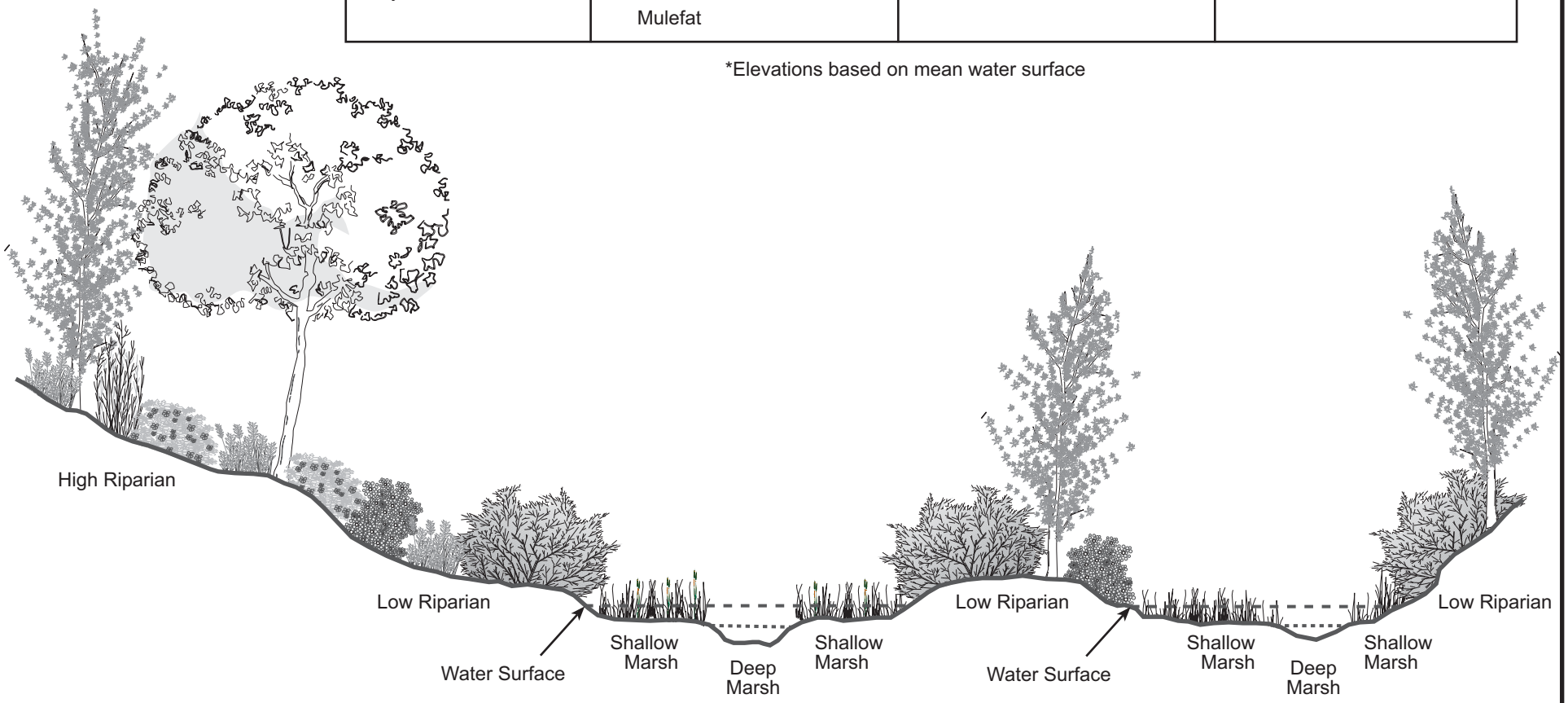

Figure 3-5
Typical Concept Planting Section
DeForest Site Alternative 2

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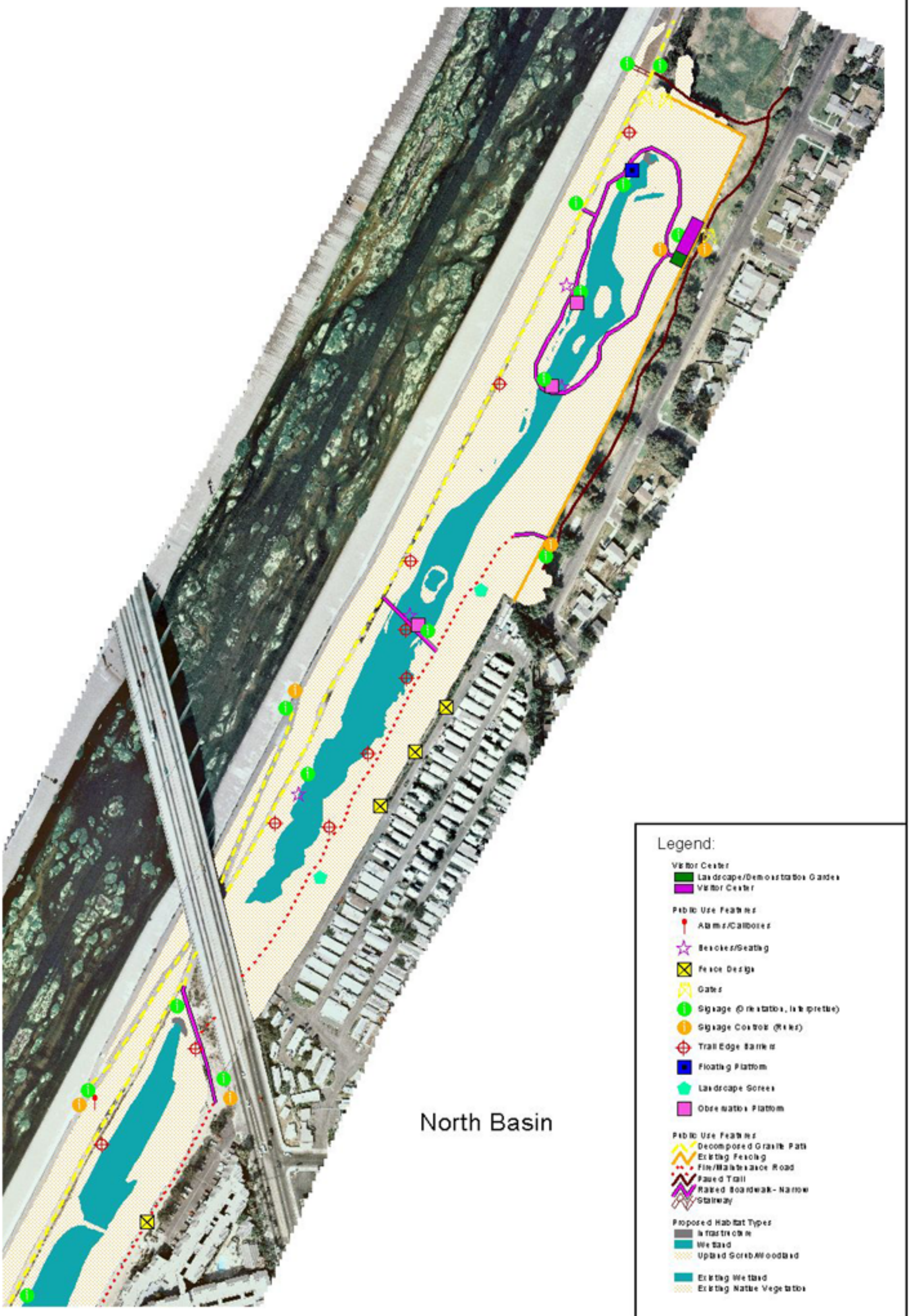

Lynn Capouya, Inc.
LANDSCAPE ARCHITECTS
A CALIFORNIA CORPORATION

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Figure 3-6
Proposed Public Use Plan
DeForest Site Alternative 2
Wetland Feasibility Study

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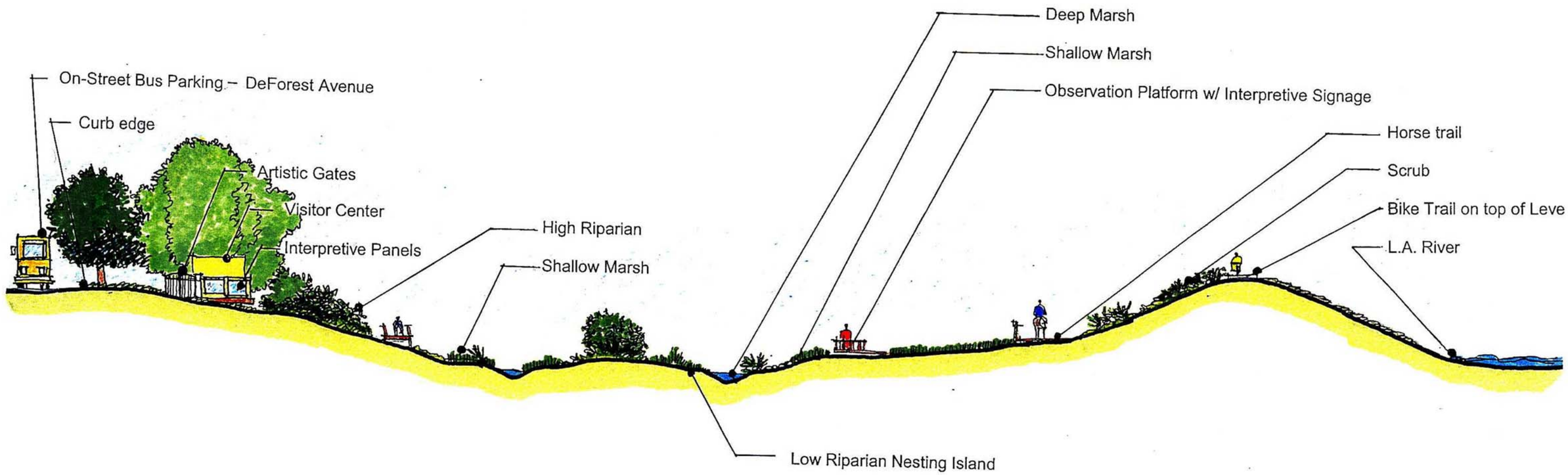

Figure 3-7
Conceptual Section Rendering, Public Use, DeForest Site Alternative 2

North Basin

Legend:

- Storm Drain Outlet

Wetland Infrastructure
- Water Control Weir
- Outfall Structures
- Pipelines
- Channel Armoring

Proposed Habitat Types
- Deep Marsh
- High Riparian
- Infrastructure
- Low Riparian
- Native Scrub
- Shallow Marsh
- Open Water
- Nesting Island
- Seasonal Wetlfat

Existing Native Vegetation

0 200 400 Feet

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Figure 3-9a
Proposed Habitat Types
DeForest Site Alternative 3
Wetland Feasibility Study

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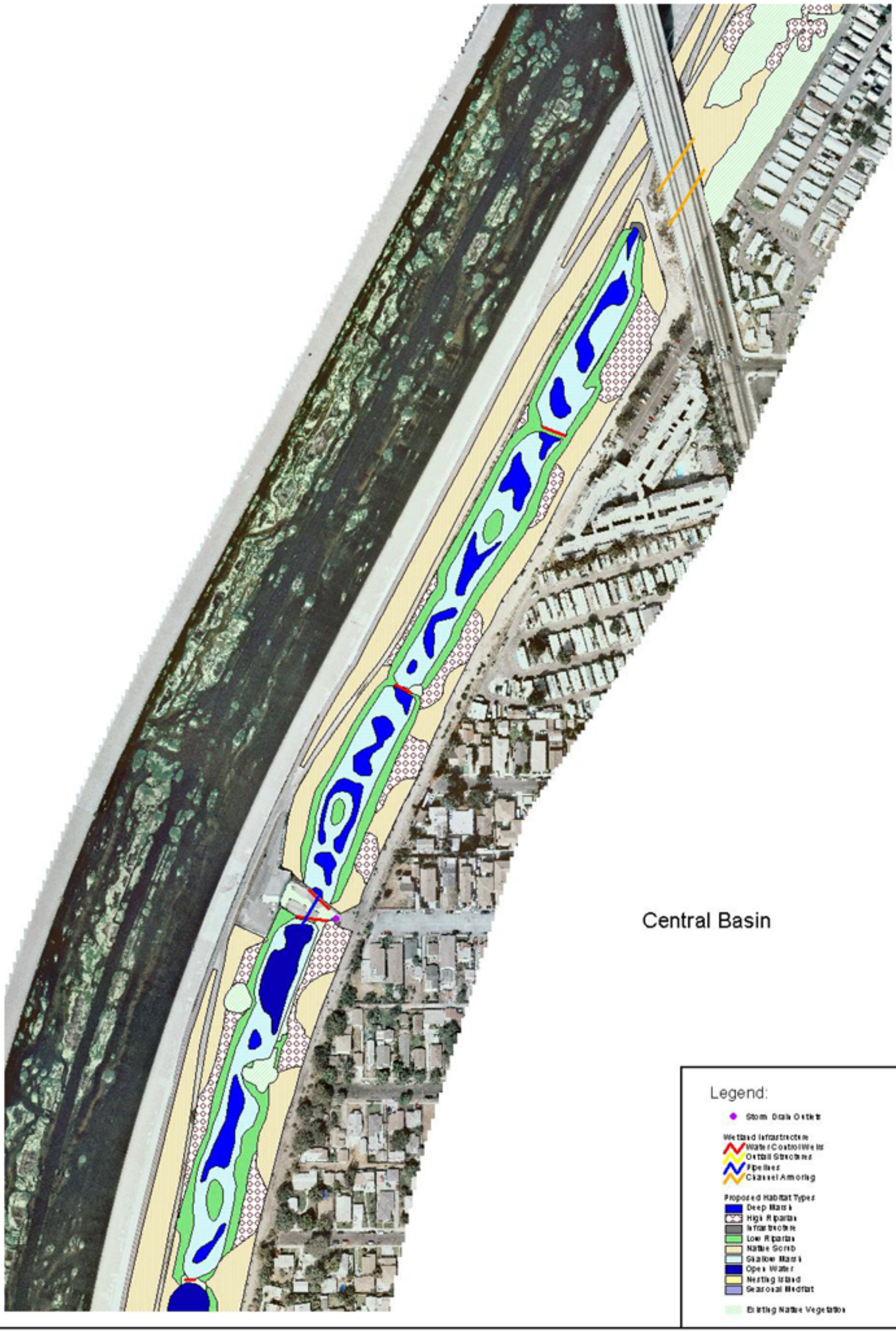

Figure 3-9b
Proposed Habitat Types
DeForest Site Alternative 3
Wetland Feasibility Study

Figure 3-9c
Proposed Habitat Types
DeForest Site Alternative 3
Wetland Feasibility Study

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Native Scrub (>6')*	Low Riparian (0' to 6')	Shallow Marsh (0' to -2')	Deep Marsh (-2' to -3')
Mulefat	Willow Sp.	Bulrush Sp.	Pondweed
Coyote Brush	Sedges	Spike-Rush	Watercress
California Croton	Mugwort	Arrowhead	Duckweed
Pruple Sage	Rush	Cattail	Water Starwort
	Mulefat		

*Elevations based on mean water surface

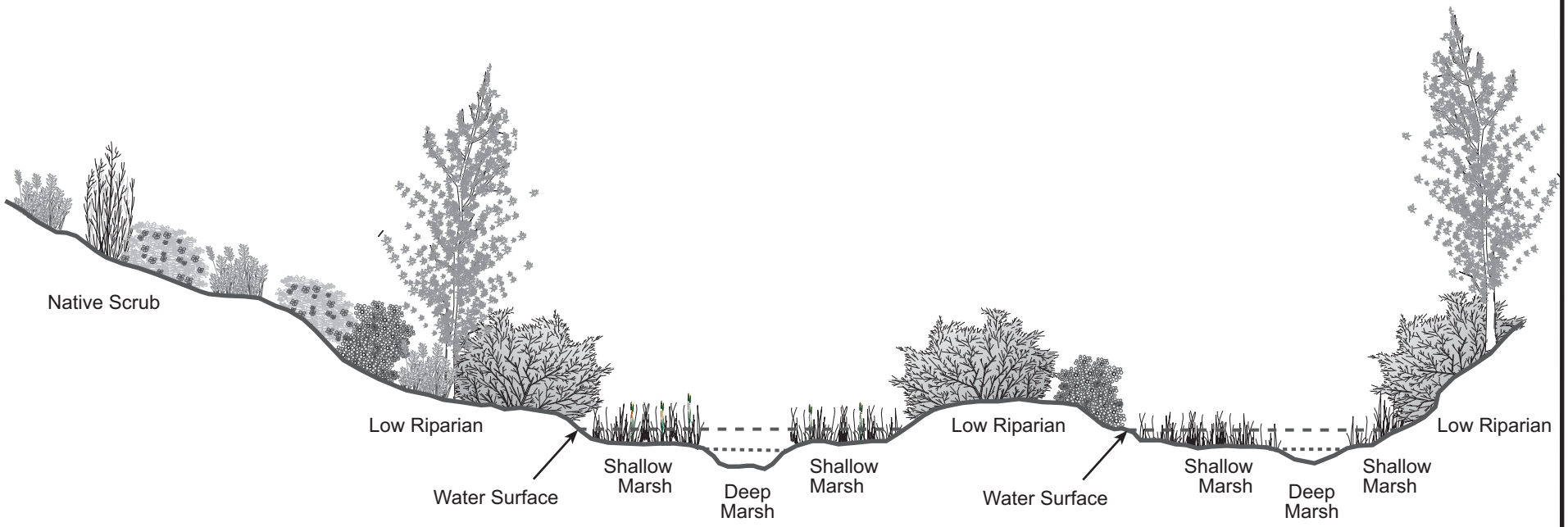

Figure 3-10
Typical Concept Planting Section
DeForest Site Alternative 3

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North Basin

Legend:

Visitor Center
- Demonstration Garden
- Parking Lot
- Visitor Center

Public Use Features
- Alarms/Callboxes
- Benches/Seating
- Fence Design
- Gates
- Signage (Orientation, Interpretive)
- Signage Controls (Rules)
- Trail Edge Barriers
- Floating Platform
- Landscape Screen
- Observation Platform
- Raised Viewing Deck

Public Use Features
- Decomposed Granite Path
- Existing Fencing
- Fire/Maintenance Road
- Paved Trail
- Raised Boardwalk- Narrow
- Stairway
- Raised Boardwalk- Wide

Proposed Habitat Types
- Infrastructure
- Wetland
- Upland Scrub/Woodland

- Existing Wetland
- Existing Native Vegetation

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Figure 3-11
Proposed Public Use Plan
DeForest Site Alternative 3
Wetland Feasibility Study

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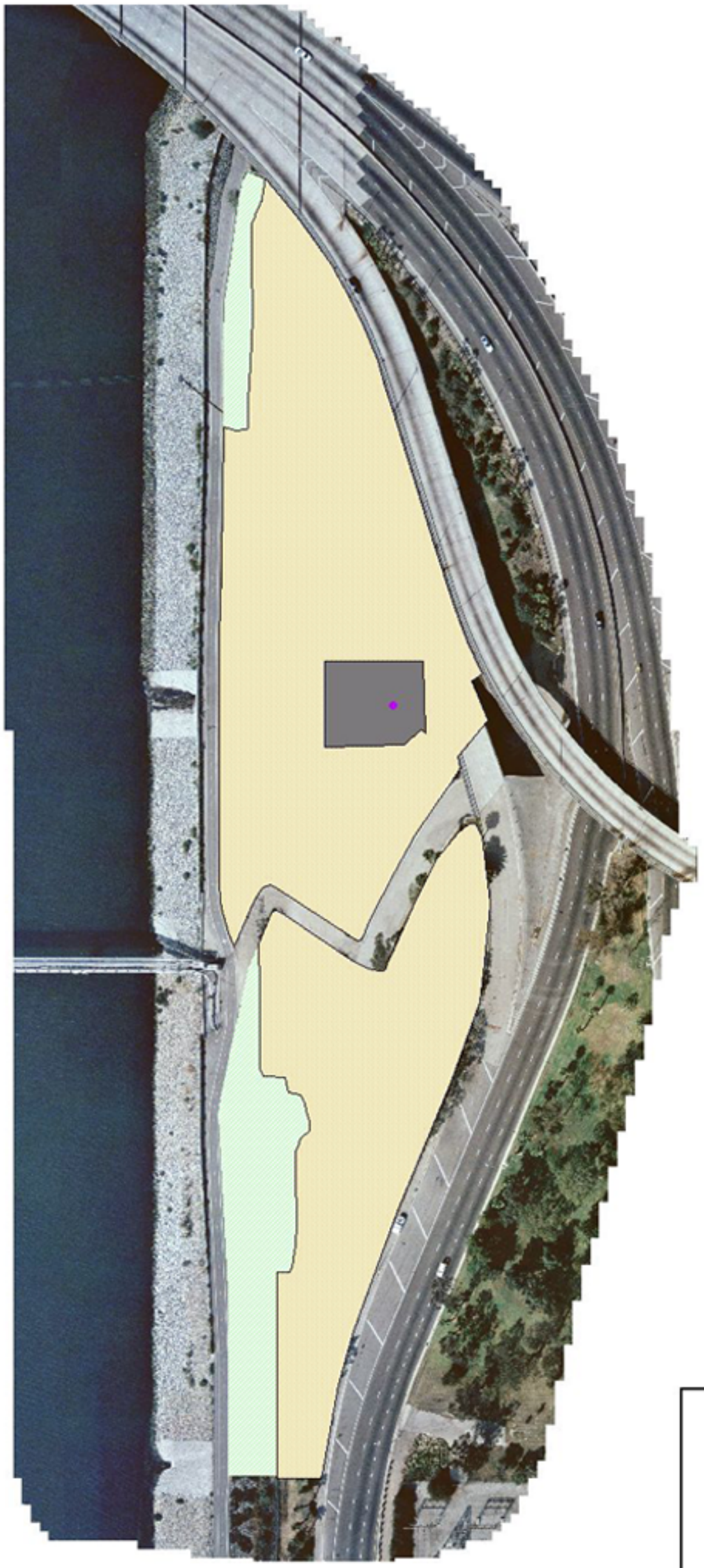

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Figure 3-12
Proposed Habitat Types
Sixth Street Alternative 1
Wetland Feasibility Study

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Figure 3-13
Proposed Public Use Plan
Sixth Street Site Alternative 1
Wetland Feasibility Study

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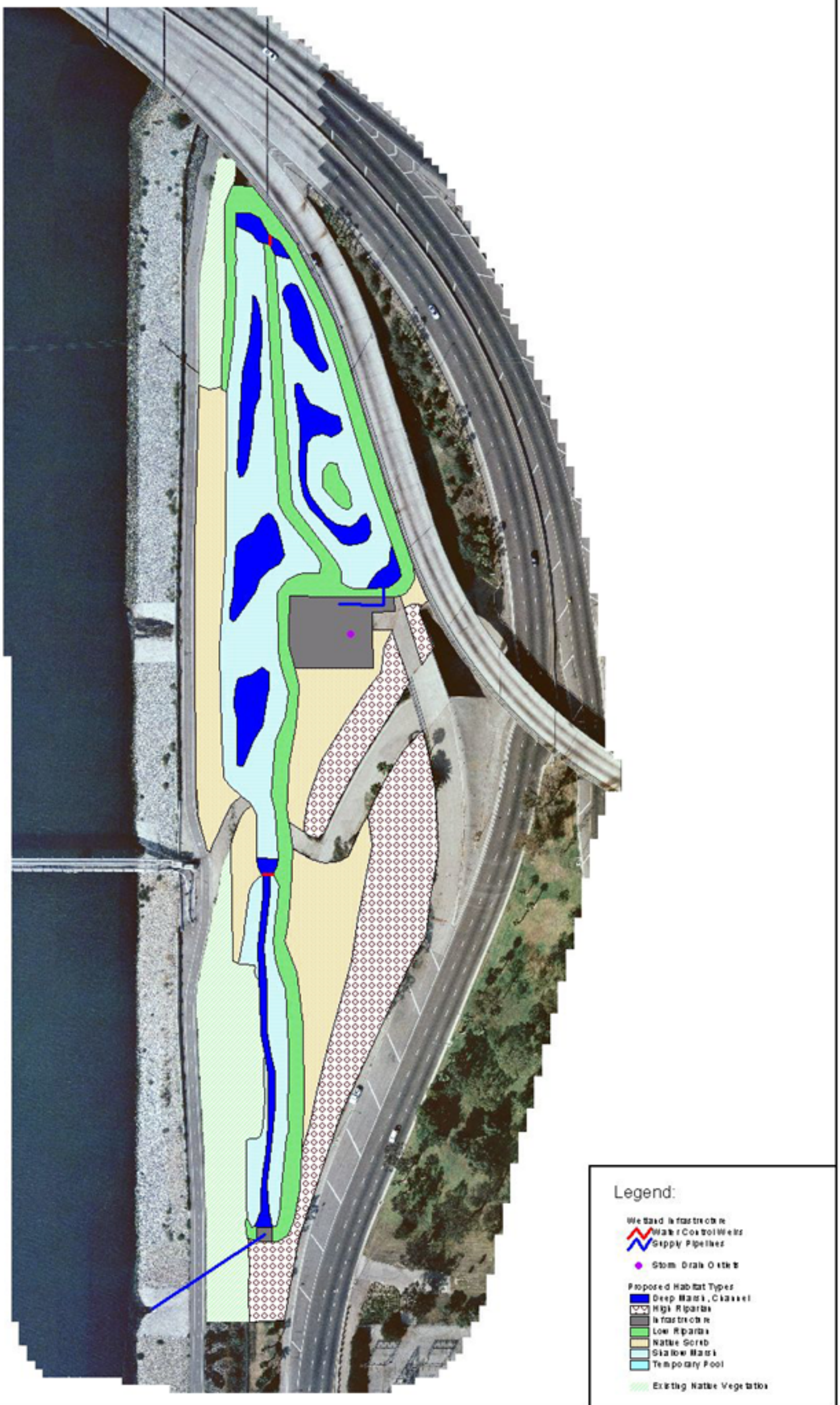

Figure 3-15
Proposed Habitat Types
Sixth Street Alternative 2
Wetland Feasibility Study

Low Riparian (0' to 6')*	Shallow Marsh (0' to -2')	Deep Marsh (-2' to -3')
Willow Sp.	Bulrush Sp.	Pondweed
Sedges	Spike-Rush	Watercress
Mugwort	Arrowhead	Duckweed
Rush	Cattail	Water Starwort
Mulefat		

*Elevations based on mean water surface

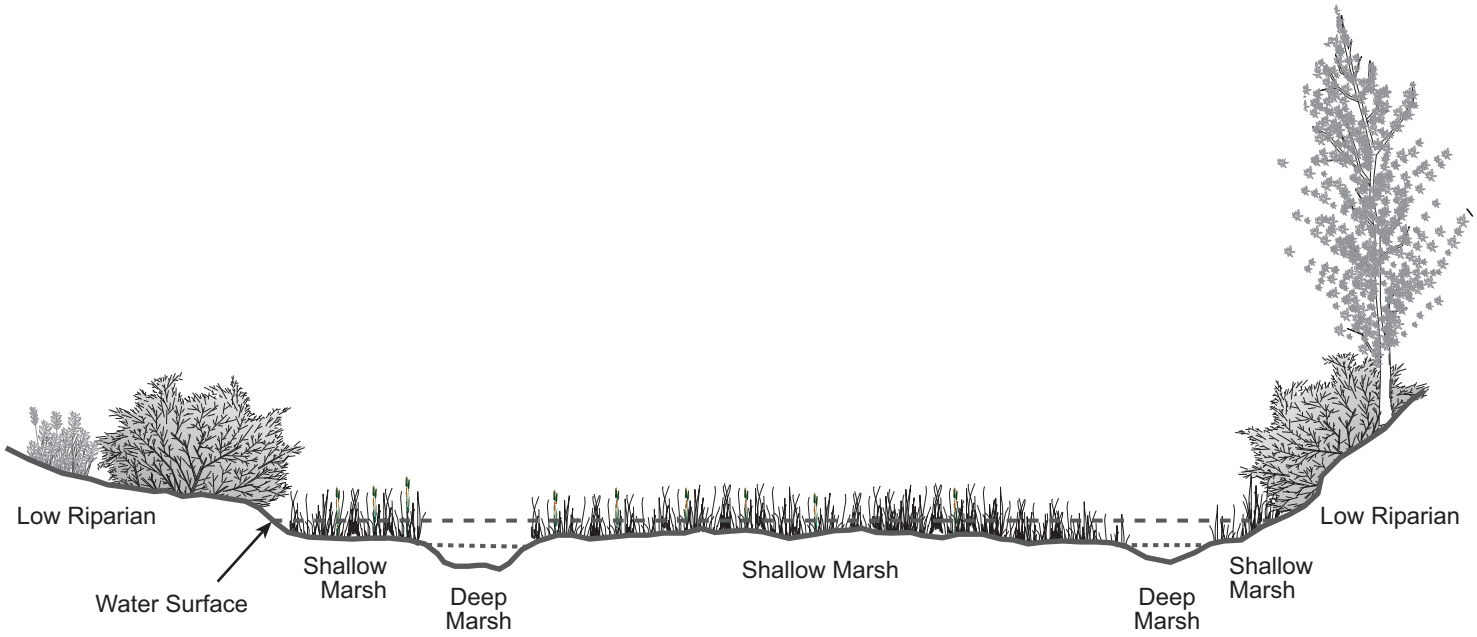

Figure 3-16
Typical Concept Planting Section
Sixth Street Site Alternative 2

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Figure 3-17
Proposed Public Use Plan
Sixth Street Site Alternative 2
Wetland Feasibility Study

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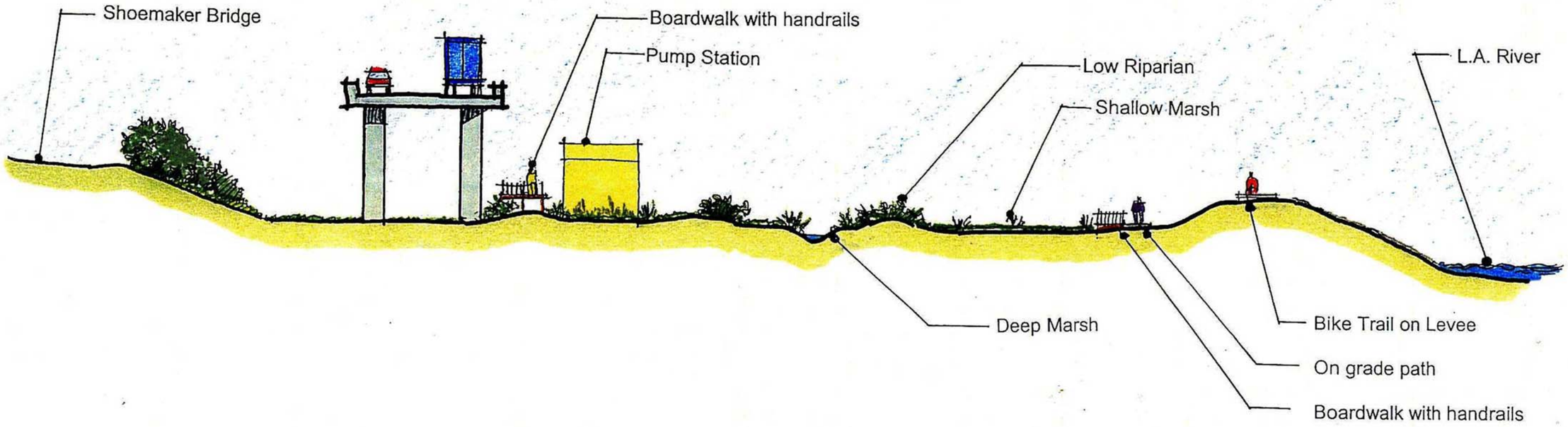

Figure 3-18
Conceptual Section Rendering, Public Use, Sixth Street Site Alternative 2

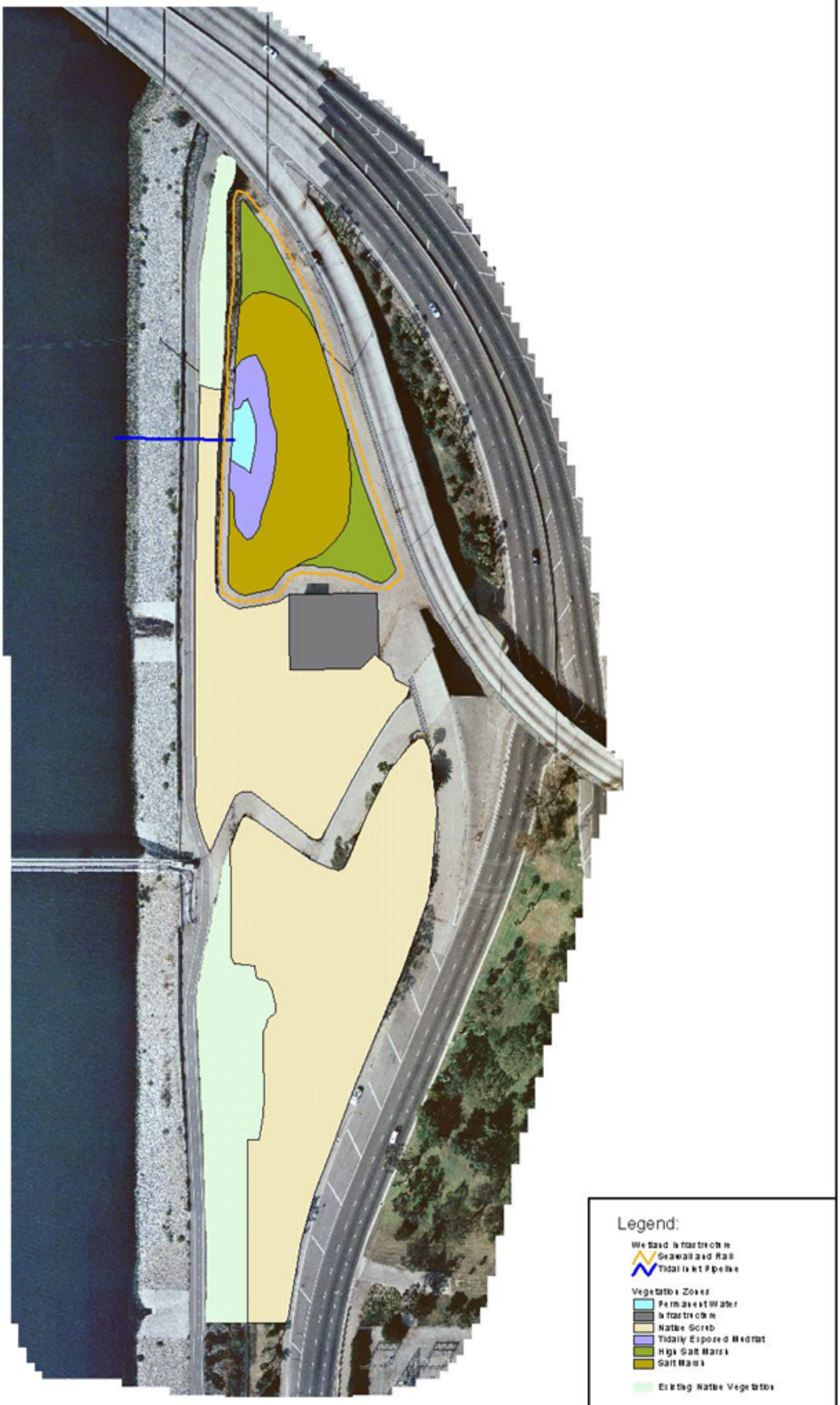

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Figure 3-19
Proposed Habitat Types
Sixth Street Alternative 3
Wetland Feasibility Study

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Salt Marsh (4' to 7')*	High Salt Marsh (7' to 10')
Pickleweed Sp.	Glasswort
Saltwort	Matscale
Sea Blite	Coulter's Goldfields
Arrow Grass	Alkali Weed

*Elevations above mean lower low water

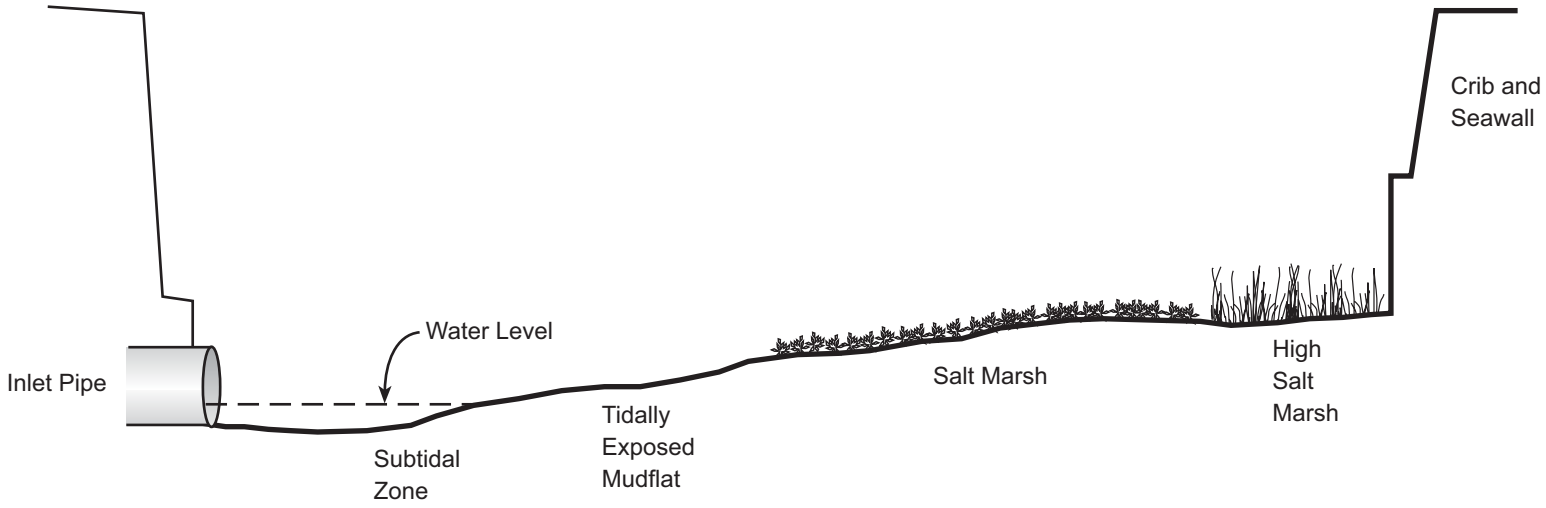

Figure 3-20
Typical Concept Planting Section
Sixth Street Site Alternative 3

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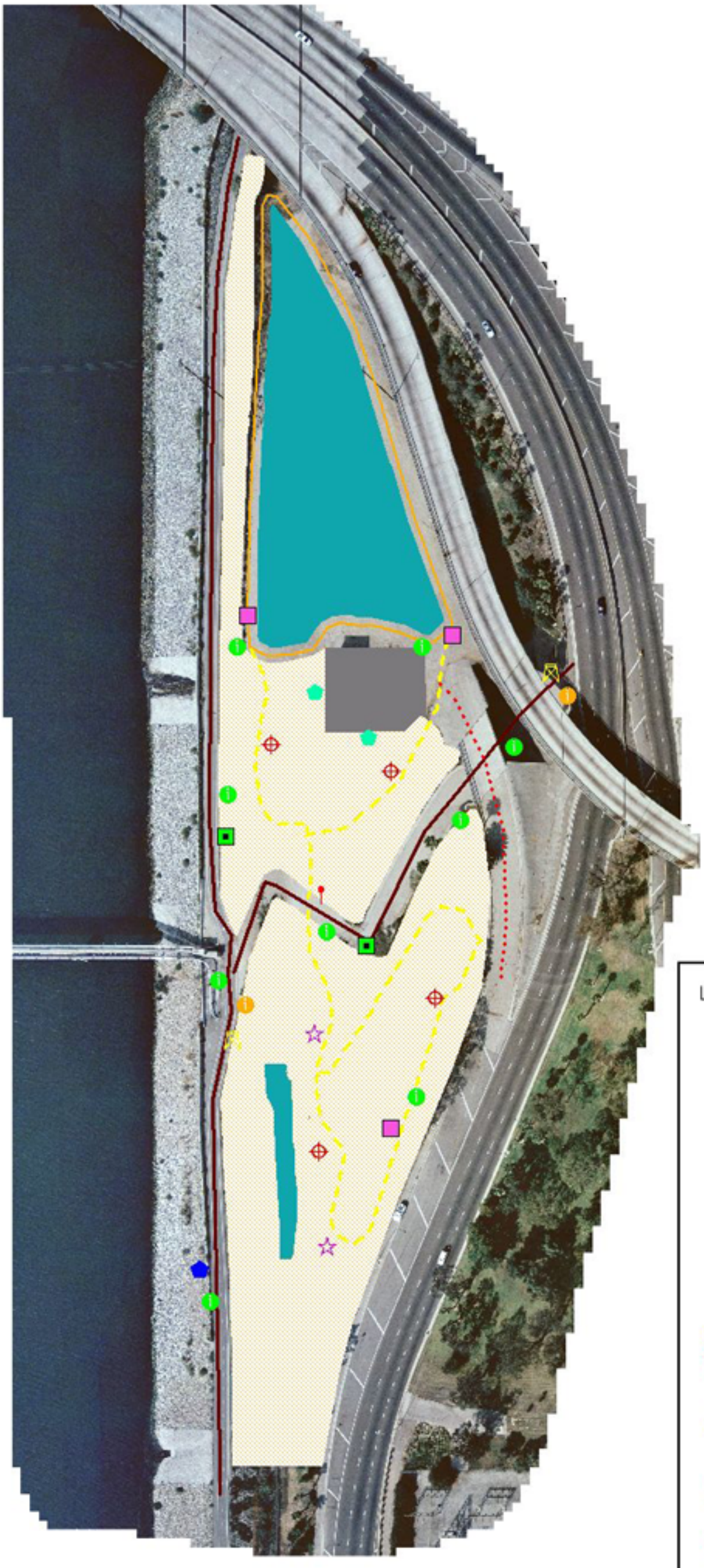

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Figure 3-21
Proposed Public Use Plan
Sixth Street Site Alternative 3
Wetland Feasibility Study

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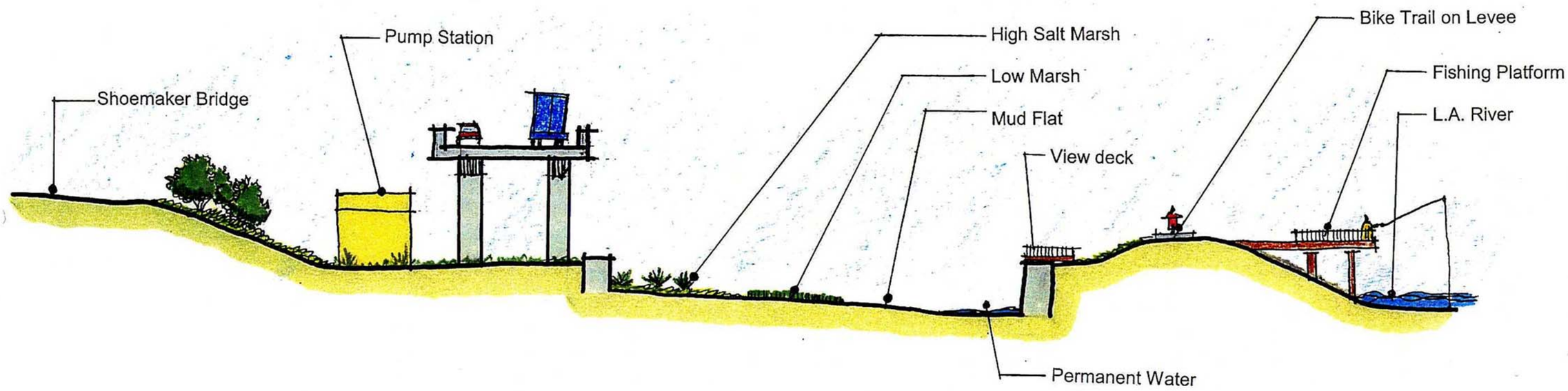

Figure 3-22
Conceptual Section Rendering, Public Use, Sixth Street Site Alternative 3

4.0 Benchscale Study

4.1 Introduction

This section presents a summary of the approach and results of CH2M HILL's bench-scale evaluation of treatment wetland and filtering technologies for the DeForest Park and Sixth Street Bridge sites in Long Beach, California. This evaluation included design and construction of a small bench-scale treatment facility, incorporating a surface-flow wetland and two independent sand filters. The purpose of the bench-scale testing was to evaluate alternatives for habitat enhancement through improved water quality (Title 22 standards) and wetland treatment for beneficial water reuse (Secondary 23 levels). If applicable, the water quality performance data will be used in the full-scale design and establishment of criteria for the final wetland and filter media.

4.1.1 Bench-Scale Design Criteria

Water quality goals for this bench-scale project were based on desired effluent quality as specified in California Title 22 standards. The Title 22 standards for recycled water are separated into two levels of disinfection according to the California Department of Health Services (DOHS) Water Recycling Criteria — disinfected secondary 2.2 and secondary 23. Secondary 2.2 recycled water has been oxidized and disinfected with the 7-day median concentration of total coliform bacteria not exceeding 2.2 MPNs per 100 ml and the total coliform bacteria not exceeding 23 MPNs per 100 ml in more than one sample in any 30-day period. Secondary 23 recycled water cannot exceed a 7-day median MPN of 23 per 100 ml or a maximum MPN of 240 per 100 ml in any sample in a 30-day period.

In addition to bacterial specifications, wastewater may be filtered through a bed of media (sand filter) as long as: (1) the rate does not exceed 5 gallons per minute per square foot of surface area, and (2) the turbidity of the filtered wastewater does not exceed a daily average of 2 nephelometric turbidity units (NTUs), 5 NTUs more than 5 percent of the time within 24 hours, or 10 NTUs at any time.

Tables 2-8 and 2-9 provide summary data for stormwater quality and Los Angeles River water quality. Additional sampling of existing conditions was conducted at the benchscale wetland inlet during the sampling period, and is indicated in Tables 4-1 and 4-2 below.

4.1.2 Bench-Scale Design/Operation

System Design

The bench-scale study utilized a constructed surface flow (SF) treatment wetland, or a shallow impoundment, planted with emergent, rooted vegetation. Water flowed primarily above the sediment surface through the wetland, which was planted with three mature plant species native to Southern California — *Typha latifolia, Scirpus acutus,* and *Scirpus californicus* (Figure 4-1). The surface flow wetland was interrupted by a series

of four 12-inch tall wooden baffles to increase the hydraulic residence time through the system. More details on the design are presented in the *Task 7 Report.*

FIGURE 4-1
Wetland Bench-Scale Demonstration Project Illustrating the Mature Plant Species

As shown in Figure 4-2, water discharging from the wetland branched into either a single-stage sand filter (left barrel) or a dual-stage sand filter (right barrel) that used sand combined with an iron filing amendment. The sand filtration augmented the overall treatment efficacy of the surface flow wetland system by trapping or absorbing pollutants and suspended particles with smaller sand particles. Sand filtration was chosen as a polishing step in the removal of total and fecal coliforms and reduction of turbidity since it is commonly used effectively in water treatment facilities. A sand-only filter was designed with two grades of silica sand to maximize removal efficiencies; a sand-iron filter integrated zero valent iron filings to help remove microorganisms.

Sampling

The filtration bench-scale test involved sampling of total coliforms, turbidity, and total suspended solids (using field sampling), as well as nutrients, metals, and organic compounds including pesticides found in DeForest Park storm drains or surface waters in the Los Angeles River system. Each experiment was conducted for 5 weeks with analytical and microbiological samples taken weekly from five sampling ports in the system.

FIGURE 4-2
Sand Filtration Equipment
The equipment consisted of the blue barrel (left) with multiple layers of fine and coarse sands and the black barrel (right) with fine sands and 4-inch layer of iron filings.

Source Water

After construction was complete on the wetland and sand filters, stormwater was collected from the 90-inch stormwater collection main on DeForest Avenue near the entrance to DeForest Park for the first 5-week run of the system, and from the Los Angeles River downstream of the DeForest Site for the second 5-week run of the system.

4.1.3 Performance Monitoring

Multiple monitoring points were established to allow comparison between system components throughout the study. Samples were removed, beginning at downstream points and working upstream through the system. Sample points 1 and 2 came from the sand-only and sand-iron filters; sample point 3 was taken immediately after discharge from the wetland outlet; sample point 4 was taken from the discharge valve for the wetland tank; and sample point 5 was removed from the inlet hose feeding the wetland inlet.

Weekly water samples collected at multiple sampling points throughout the system, including from the inlet, the wetland outlet, and from each of the sand filters. Samples were analyzed in the field for temperature, pH, specific conductivity, and oxidation reduction potential (ORP) by hand probes; dissolved oxygen (DO) was conducted on site by the City; total and fecal coliform counts, and additional analytical work (five metals, nutrients, and pesticides) were performed by off-site laboratories.

4.2 Experimental Results

In summary, for the Title 22 standard criteria total and fecal coliforms and turbidity, the combination surface flow wetland and sand filters had satisfactory performance using DeForest Park source water and exceeded expectations when Los Angeles River water was used. Total and fecal coliform counts declined as expected throughout the treatment system during the DeForest Park Stormwater study. Ammonia-nitrogen increases were recorded within the wetland likely due to the application of fertilizer. The sand filters effectively removed ammonia as well as nitrates, TKN, and phosphorus during the study. Turbidity values increased slightly after discharging from the sand filters indicating possible resuspension of settled particles during sampling.

The use of sand filtration illustrated effective removal of total and fecal coliforms during the Los Angeles River water study. Both sand filters had greater than 99.5-percent reductions in total coliforms while consistently removing fecal coliforms to below Title 22 standards on all but one occasion. Ammonia-nitrogen was removed to below detection limits in the sand-only filter and to a lesser degree in the sand-iron filter while nitrates, TKN, and phosphorus were unchanged through the sand filters. Turbidity declined to below 2 NTU in the sand-iron filter by week 5 while decreasing slightly in the sand-only filter.

4.2.1 DeForest Park Stormwater Results

Table 4-1 summarizes DeForest Park stormwater data collected from each sampling station during the five weeks of the study.

Total and Fecal Coliform

Data collected from weeks 2 and 3 show 91-percent and 97.5-percent reductions in total coliform, respectively, between the wetland inlet and the sand-only filter, demonstrating the effectiveness of the filtration equipment after conditioning (Figure 4-3). The results for the iron-sand filter during the same period had less conclusive results. The sand-only filter performed consistently well in removing fecal coliform over the test period with counts

generally less than 4 MPNs per 100 mL. The sand-iron filter also performed consistently well with typical counts under 8 MPNs per 100 mL.

Nutrients

Ammonia-Nitrogen. Aside from an early increase increase in ammonia levels between the wetland inlet and outlets (probably from slow release fertilizer added to the wetland), ammonia was effectively removed by the sand filters. By weeks 3 and 5, ammonia-nitrogen was consistently removed to below method detection limits.

Nitrate-Nitrogen. The sand-only filter realized a 53-percent reduction in week 3 and a 75-percent reduction in week 5 while the sand-iron filter performed well by taking nitrate levels to below the method detection limits (Figure 4-4).

TKN. Values for TKN steadily declined over the 5-week study although levels exiting the wetland exceeded the inlet values. Over the entire period, the sand-iron filter outperformed the sand-only filter, recording TKN reduction percentages of 91.1 to 87.5, respectively.

Total Phosphorus. Phosphorus levels declined with treatment through the sand-only filter although not as extensively as through the sand-iron filter. Over the 5-week period, the sand-only filter reduced total phosphorus levels by 54 percent as compared to 91 percent with the sand-iron filter.

Turbidity

Influent turbidity values declined over the 5-week period due in part to stagnation in the storage tank. In the sand-only filter, the data generally showed steadily increasing values of turbidity from 2.9 to a high of 14 NTUs. Likewise, the sand-iron filter showed a steady increase in turbidity of 2.8 to 5.4 NTUs, although not as high as the sand-only filter. Disturbance of settled material during sampling may explain increases in these data.

4.2.2 Los Angeles River Water Results

Table 4-2 summarizes DeForest Park Los Angeles River data collected from each sampling station during the five weeks of the study.

Total Coliforms

Total coliform counts showed variability over time when the system used Los Angeles River water. Variable counts corresponded to inputs of fresh water deliveries to the storage tank at the beginning and again between weeks 3 and 4. Both the sand-only and sand-iron filters followed this overall trend but at considerably lower levels. Data collected between weeks 4.33 and 5 show 99.99-percent and 99.69-percent reductions between the wetland outlet and the sand-only and sand-iron filters, respectively, demonstrating the effectiveness of the conditioned filtration equipment after the introduction of fresh river water to the storage tank.

TABLE 4-1
Bench Scale Wetland Water Treatment Analysis for DeForest Park Stormwater

			Wetland Inlet				Wetland Outlet				Sand – Only Filter				Sand – Iron Filter			
	Units	**Lab MRL**	**Max**	**Min**	**Mean**	**Median**	**Max**	**Min**	**Mean**	**Median**	**Max**	**Min**	**Mean**	**Median**	**Max**	**Min**	**Mean**	**Median**
Dissolved Oxygen (DO)	mg/L	0.3	8.0	2.7	4.9	3.9	8.0	4.1	6.9	7.2	12.5	6.3	9.70	11.0	7.4	1.6	5.20	5.9
Oxidation-Reduction Potential (ORP)	mV	5.0	77	-27	11.9	-0.5	86.0	-26.0	17.8	11.0	90.0	-124	-21.8	-51.0	-19	-158	-119	-144
pH		0.1	7.7	7.6	7.6	7.6	7.7	7.0	7.3	7.3	7.5	7.1	7.3	7.4	8.8	8.3	8.4	8.4
Specific Conductivity	µS/cm	1.0	707	642	665	650	735	621	664	659	760	606	667	671	670	436	569	608
Temperature (°F)	°F	0.1	65.1	56.1	60.6	61.2	57.0	44.6	51.2	50.9	59.5	43.3	51.6	52.7	60.1	52.5	56.3	57.2
Biochemical Oxygen Demand (BOD)	mg/L	10.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Coliforms	MPN/100 mL	2	1600	30	692	900	1600	500	1160	1600	1600	22	620	500	900	240	635	700
Fecal Coliforms	MPN/100 mL	2	350	2	79	13	17	2	6	4	110	2	24	2	900	7	234	15
Aluminum - Metal	mg/L	0.1	0.1	0.1	0.1	0.1	ND	ND	ND	ND	0.7	0.7	0.7	0.7	0.3	0.1	0.2	0.2
Barium - Metal	mg/L	0.02	0.08	0.07	0.08	0.08	0.06	0.04	0.05	0.06	0.05	0.03	0.04	0.05	0.03	0.02	0.025	0.025
Copper - Metal	mg/L	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron - Metal	mg/L	0.1	0.4	0.4	0.4	0.4	0.6	0.02	0.3	0.2	0.9	0.2	0.5	0.3	0.4	0.3	0.3	0.3
Lead - Metal	mg/L	0.002	0.002	0.002	0.002	0.002	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrate (NO_3)	mg/L	1.0	4.3	0.1	2.8	4.0	1.6	0.1	0.6	0.1	2.0	0.1	1.0	1.0	0.1	0.1	0.1	0.1
Ammonia (NH_3)	mg/L	0.1	1.0	0.3	0.5	0.3	4.6	0.05	1.6	0.05	4.4	0.05	1.5	0.05	1.5	0.05	0.58	0.2
Total Kjeldahl Nitrogen (TKN)	mg/L	0.3	1.4	0.1	0.70	0.6	5.6	0.9	2.5	1.0	4.9	0.4	2.0	0.7	2.6	0.50	1.20	0.50
Total Phosphorus (P)	mg/L	0.10	0.7	0.6	0.6	0.7	2.3	1.3	1.7	1.5	2.3	1.0	1.5	1.2	0.2	0.05	0.12	0.11
Orthophosphate as Phosphate	mg/L	1.0	2.0	0.74	1.20	0.85	2.0	0.9	1.6	1.9	2.0	1.0	1.7	2	0.5	0.50	0.5	0.50
Total Suspended Solids (TSS)	mg/L	10.0	ND	ND	ND	ND	ND	ND	ND	ND	45.0	16.0	30.5	30.5	26	26	26	26
Turbidity	NTU	0.1	5.4	0.5	1.9	1.4	4.1	1	2.2	2	14	2.9	8.8	9.0	15	1.4	5.5	3.0

ND – Non Detect values are below the laboratory MRL values displayed

TABLE 4-2
Bench Scale Wetland Water Treatment Analysis for Los Angeles River Stormwater

			Wetland Inlet				Wetland Outlet				Sand – Only Filter				Sand – Iron Filter			
	Units	**Lab MRL**	**Max**	**Min**	**Mean**	**Median**	**Max**	**Min**	**Mean**	**Median**	**Max**	**Min**	**Mean**	**Median**	**Max**	**Min**	**Mean**	**Median**
Dissolved Oxygen (DO)	mg/L	0.3	13.88	1.44	5.19	2.72	8.00	4.38	6.05	5.90	12.50	9.41	10.60	10.24	4.56	0.60	1.64	0.69
Oxidation-Reduction Potential (ORP)	mV	5.0	-37.00	-56.00	-46.00	-48.00	50.00	-9.00	11.14	11.00	77.00	-129.00	-1.57	43.00	-129.00	-185.00	-158.00	-165.00
pH		0.1	8.60	7.90	8.24	8.20	7.40	6.90	7.14	7.20	7.40	6.90	7.20	7.30	8.90	8.30	8.57	8.60
Specific Conductivity	µS/cm	1.0	1041.00	668.00	902.86	924.00	1041.00	889.00	945.43	945.00	1060.00	918.00	967.14	972.00	922.00	714.00	796.14	785.00
Temperature (°F)	°F	0.1	75.20	61.50	67.89	68.90	64.80	54.30	58.33	58.00	65.50	54.10	58.34	57.90	69.60	58.50	63.57	63.00
Biochemical Oxygen Demand (BOD)	mg/L	10.0	12.00	11.00	11.50	11.50	12.00	12.00	12.00	12.00	ND	ND	ND	ND	11.00	ND	ND	ND
Total Coliforms	MPN/100 mL	2	500	23	128	80	23000	30	10317	13000	8000	2	2365	230	3000	50	689	130
Fecal Coliforms	MPN/100 mL	2	80	4	22	11	17	2	5	2	2	2	2	2	4	2	2	2
Aluminum - Metal	mg/L	0.1	ND	ND	ND	ND	ND	ND	ND	ND	0.20	0.20	0.20	0.20	0.50	0.40	0.45	0.45
Barium - Metal	mg/L	0.02	0.08	0.07	0.08	0.08	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.04	0.03	0.04	0.04
Copper - Metal	mg/L	0.01	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron - Metal	mg/L	0.1	ND	ND	ND	ND	1.00	0.09	0.55	0.55	0.40	0.20	0.30	0.30	0.50	0.50	0.50	0.50
Lead - Metal	mg/L	0.002	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrate (NO_3)	mg/L	1.0	14.00	8.60	11.87	13.00	2.50	0.10	0.90	0.10	8.00	2.00	4.73	4.20	1.00	ND	ND	ND
Ammonia (NH_3)	mg/L	0.1	1.80	0.05	0.95	1.00	1.20	0.05	0.43	0.05	0.20	0.05	0.10	0.05	0.50	0.20	0.37	0.40
Total Kjeldahl Nitrogen (TKN)	mg/L	0.3	2.80	0.90	1.80	1.70	3.10	1.50	2.30	2.30	1.40	1.00	1.23	1.30	1.00	0.10	0.67	0.90
Total Phosphorus (P)	mg/L	0.10	0.65	0.53	0.60	0.63	1.56	0.76	1.08	0.92	0.67	0.51	0.57	0.52	0.26	0.17	0.22	0.24
Orthophosphate as Phosphate	mg/L	1.0	2.00	1.40	1.67	1.60	1.40	1.00	1.20	1.20	1.50	1.00	1.23	1.20	ND	ND	ND	ND
Total Suspended Solids (TSS)	mg/L	10.0	ND	ND	ND	ND	12.00	ND	12.00	ND	ND	ND	ND	ND	57.00	12.00	ND	ND
Turbidity	NTU	0.1	2.20	1.00	1.39	1.20	5.00	1.40	3.03	2.60	7.90	1.80	5.59	6.40	31.00	1.20	11.71	9.20

ND – Non Detect values are below the laboratory MRL values displayed

Fecal Coliforms

Fecal coliform data showed extremely low values in both sand filters over time. The sand-only filter performed extremely well over the test period with counts below the method detection limit of 2 MPNs per 100 for every sampling event. The sand-iron filter also performed consistently well, only exceeding the detection limit once at week 3 with a fecal coliform count of 4 MPNs per 100 mL (Figure 4-5). Title 22 standards were consistently achieved for fecal coliform removal with the exception of the single event.

Nutrients

Ammonia-Nitrogen. Over the sampling period, ammonia was effectively removed by the sand-only filter and to a lesser extent by the sand-iron filter. Ammonia-nitrogen was consistently removed from the experimental wastestream to below method detection limits from the sand-only filter for a minimum 94-percent removal rate. The sand-iron filter experienced a 72-percent reduction over the same period (Figure 4-6).

Nitrate-Nitrogen. Wetland influent nitrate levels were elevated over the sampling period. The surface flow wetland provided effective denitrification by consistently removing nitrate to below detection limits during each sampling period. The sand-only filter did not appear to reduce nitrate at all while the sand-iron filter performed well by taking nitrate levels to at, or below, the method detection limits for each sampling period.

TKN. Over the entire period, the sand-iron filter outperformed the sand-only filter with TKN reduction below the detection limit. There was essentially no decline in TKN in the sand-only filter.

Total Phosphorus. Phosphorus levels remained unchanged with treatment through both the sand-only and sand-iron filters. Phosphorus concentrations increased after the wetland outlet, which may have resulted from fertilization of wetland soils during construction.

Turbidity

Influent turbidity values remained steady over the sampling period, in part because of stagnation in the storage tank. Slight declines in turbidity were noted after the wetland outlet although the values were double the inlet values. Disturbance of settled material during sampling could explain outlet increases. The sand-only filter data showed fluctuating results, which were not directly comparable to the wetland effluent. Sand-only turbidity declined after spikes of fresh water were introduced into the system. Turbidity data from the sand-iron filter showed spikes in response to fresh water inputs, but rapidly declined to 1.2 NTUs by week 5, a drop of 96 percent during that week.

4.3 Discussion

The wetland bench-scale demonstration project was successful in reducing total and fecal coliforms although the data from the two filter units were only measured against the Title 22 standards for Secondary 23 recycled water. Early in the establishment of the bench-scale study, it was evident that the system was undergoing "conditioning." This refers to a break-in period in which the sand filters' media acquire a thin growth of bacteria that eventually assist in the capture and retention of pollutants traveling through the pore water. Real

capture and treatment by the system was not strongly evident until the latter half of the experiment when Los Angeles River water study was in progress. Removal successfully occurred between the wetland outlet and after each of the sand filters; each filter effectively reduced coliforms to below detection limits for the sand-only filter and to 50 MPNs per 100 mL for the sand-iron filter. Further reduction was likely, given additional time.

Other factors affecting the results include the likely possibility of short-circuiting within the sand filters. This condition is easy to develop and difficult to correct, especially on low-flow conditions such as this design. Pulse flow over the sand filters in addition to larger volumes of water would remove the environmental settings that are favorable for the development of short-circuiting when considering this sand filter in scale-up operations.

Turbidity results were not as strong as expected and this may be due to several factors. The sampling protocols were adjusted during the study to remove the possibility of particles being resuspended into solution during the actual sampling activity, creating artificially high turbidity counts. The new protocol took effect with samples taken during the Los Angeles River water study between weeks 4.33 and ending on week 5. Turbidity data showed a spike on week 4.33 and fell to levels below recommended minimum Title 22 levels of 2 NTUs. With additional testing, the data strongly support the possibility that the sand filtration units would be able to successfully treat this parameter to below Title 22 requirements.

The surface flow wetland and sand filters demonstrated that the combination of natural treatment and low maintenance equipment can successfully remove nutrients such as nitrates, ammonia, TKN, and phosphorus. Additional long-term testing of water from this setup would provide adequate supplemental information when considering scale-up to full-scale wetland and filtration in a field setting.

Data collected from this bench-scale wetland study illustrates the effective treatment capabilities of surface flow wetlands and sand filters when used in series. It is important to note that these data show trends indicating successful reductions in the Title 22 criteria of interest. After a period of conditioning, as seen with the use of Los Angeles River water as the second source water, sand filters are efficient treatment tools to achieve these requirements. Factors such as loading, flow, and maintenance will impact the long term efficacy of these units on a full-scale operation therefore careful consideration.

Figures – Section 4.0

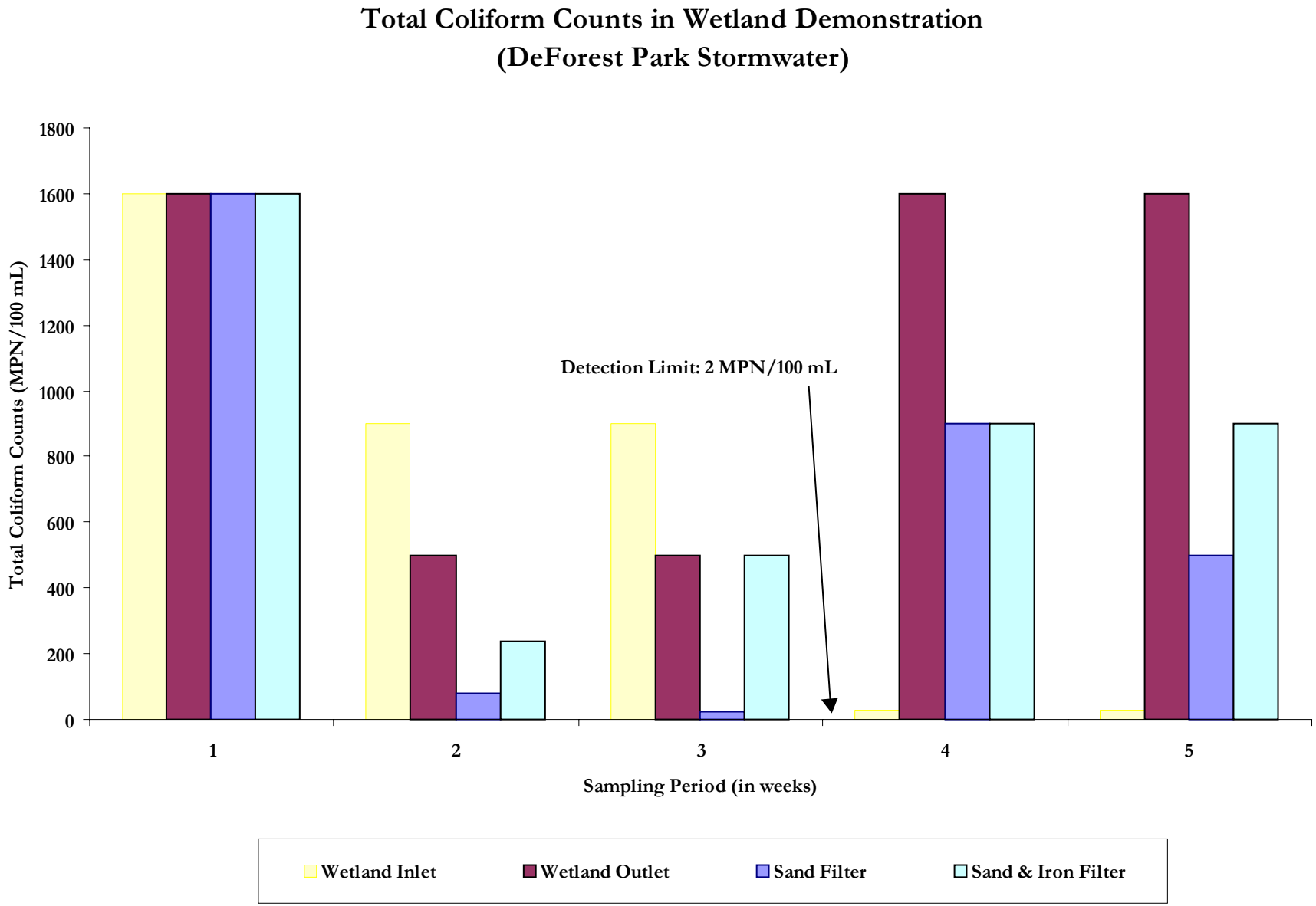

FIGURE 4-3
Total Coliform Counts in Wetland Demonstration Using DeForest Park Stormwater

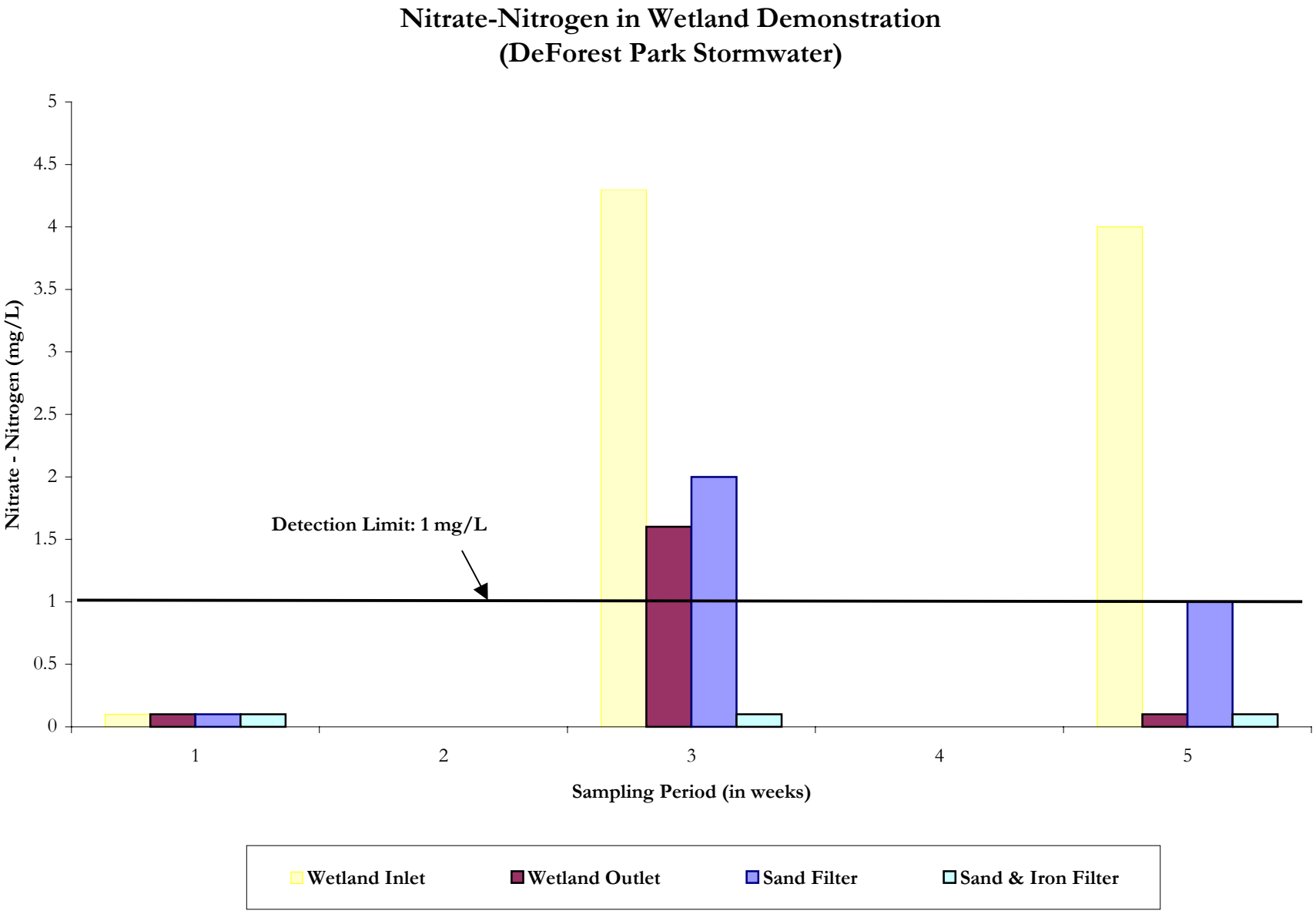

FIGURE 4-4
Nitrate-Nitrogen in Wetland Demonstration Using DeForest Park Stormwater

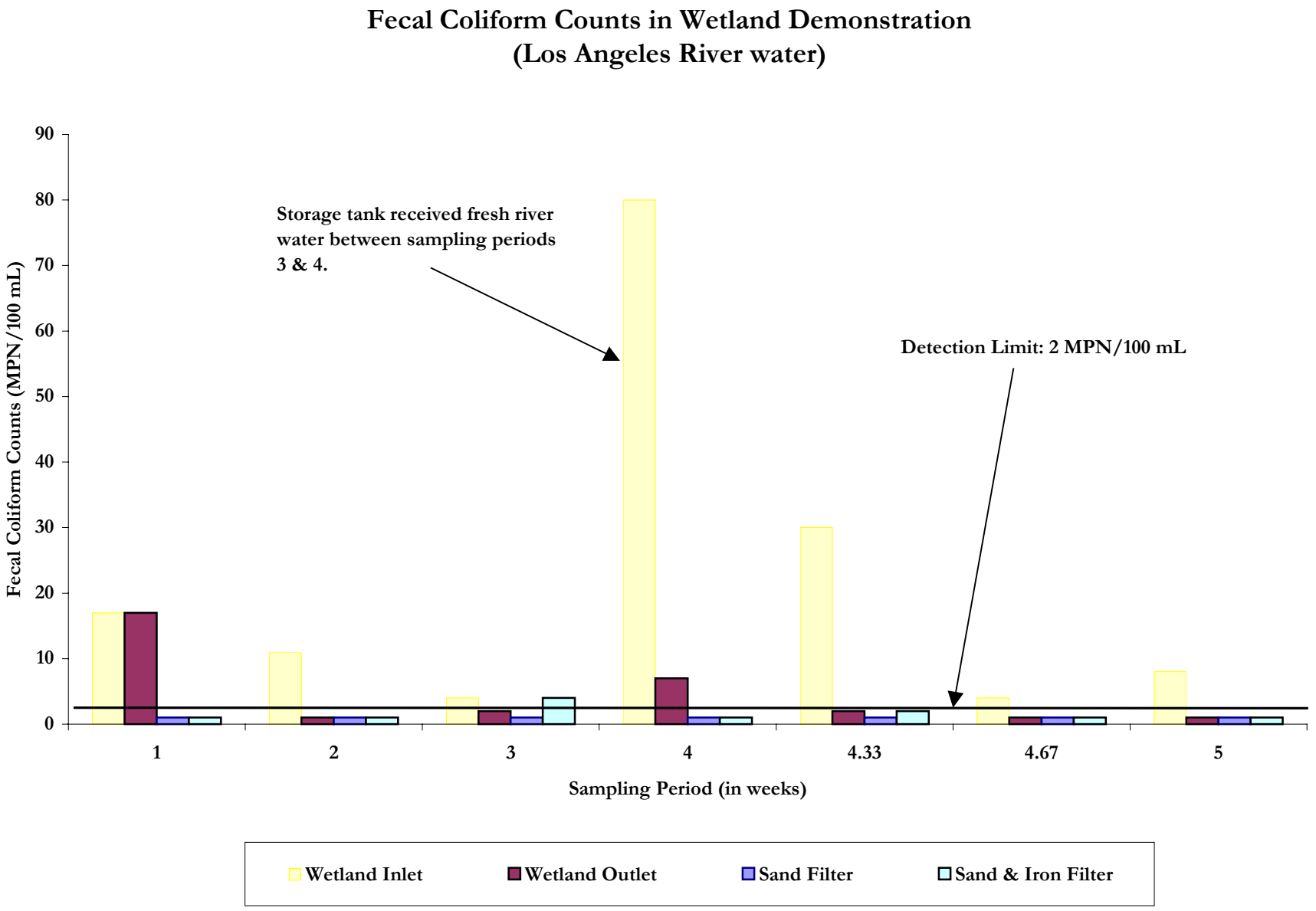

FIGURE 4-5
Fecal Coliform Counts in Wetland Demonstration Using Los Angeles River Water

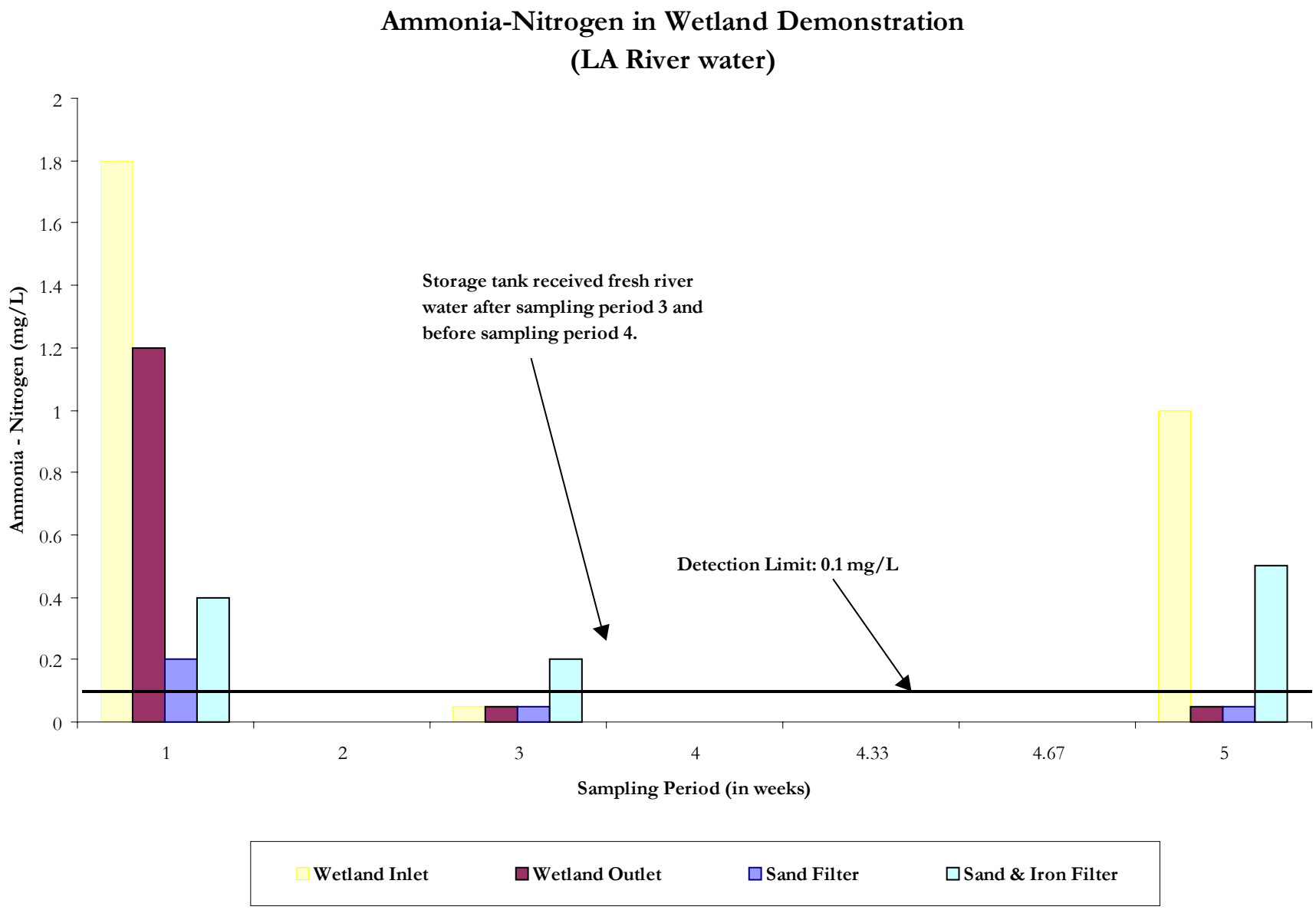

FIGURE 4-6
Ammonia-Nitrogen Concentrations in Wetland Demonstration Using Los Angeles River Water

5.0 Recommendations

5.1 DeForest Site Alternatives

5.1.1 Physical Development

Site Surveys

Site grades under Alternatives 2 and 3 were developed on initial topography, developed from new aerial photography flown in October, 2001, and site field surveys to ground truth contour mapping. However, some features with critical elevations were identified in the Study, and these elevations will require additional verification. This includes the storm drain inverts in the North Basin for the Harding Street SD and SD 129. Any changes in these invert elevations for project design would probably not be cost effective, given that it would require hydraulic analysis of the storm drain system and possible upstream changes. For this reason, wetland basins were designed off a presumed maximum elevation of 32.0 feet msl for the storm drain invert. The following recommendations are included:

- The storm drain elevations should be verified by field survey, and wetland cell elevations revised according to any differences from this elevation.
- The elevation of the exposed sewer line crossing south of North Long Beach Boulevard should be verified, since this structure is incorporated in a water control structure to avoid moving it.

Hydraulic Analysis

Full hydraulic analysis was not conducted for the wetland cell design; preliminary estimates based on probable conditions were developed; accordingly,

- Hydraulic analysis be conducted once final grading elevations are established, to verify residence times, flow rates, and final water surface elevations based on Manning's roughness coefficient.

5.1.2 Utilities and Infrastructure

Trash Removal and Storm Drain Rehabilitation

The storm drains that discharge into DeForest Site currently develop scour pools just downstream of the outlets. Trash removal in these drains consists of removal of large debris by trash racks. The Study has recommended upgrades to these outlets to eliminate the unsightly scour pools and better capture and remove trash. Updated solutions and technology is available, and was reviewed in the Study. The following recommendations are included:

- A combination of solutions should be identified, and the infrastructure required for this designed. The final trash removal system and the rehabilitation of the storm drains will ultimately require compatibility and should be designed together.

- The potential for final designs of storm drain outlets with concrete articulated to look like natural rock bed, or actual use of natural materials should be evaluated (CH2M HILL 2002c).
- LACDPW (2002) recommends evaluation of "End-of-the-Pipe Trash Removal Systems" by Stormwater Systems-Australia. These systems should be further evaluated.

Utility Conflicts

As stated above, the elevation of the exposed sewer line crossing south of North Long Beach Boulevard should be verified, since this structure is incorporated in a water control structure to avoid moving it. If the elevation is found incompatible with wetland cell development, the utility may need to be moved. In addition, the soils around the structure may become saturated; the potential for impacts to the line from this should also be evaluated.

Under Alternative 3, a pipeline would be required to provide outlet of the water to DGSG. Several utility line crossings are present along Del Amo Boulevard in this location. No conflicts are anticipated, since the outlet pipe would be several feet beneath the roadway, but this should be verified.

Infrastructure Conflicts

Conceptual designs for Alternatives 2 and 3 would result in flowing and/or standing water beneath the North Long Beach Boulevard overpass. A geotechnical review and analysis of bridge pier structural stability under those conditions is advisable, since surrounding soils may become saturated. This analysis would determine the extent of likely saturation and the potential effects, if any, on bridge pier support.

5.1.3 Water Supply

Stormwater

Current volume of stormwater flow is estimated, but is not known. This flow amount should be verified throughout the year to determine its contribution to supporting wetlands on the site.

Los Angeles River Water

Water rights for the Los Angeles River are currently under investigation by the LACDPW. This would require a final determination before initiating final designs using this as a water source (Alternative 2). In addition, using this water for the DeForest Site may require a Change in Use and/or Change in Diversion, as issued by the State Water Resources Control Board for an existing water right.

Interstate 105 Water

WRD, in conjunction with Komex, is currently completing a Feasibility Study on the use of this water in the DeForest Basin for infiltration and habitat enhancement. Final results from this study should be evaluated, and other factors affecting the availability of this water. No further design on Alternative 3 for DeForest Site should be conducted until a final determination on the fate of this water is made.

If the water does become available to the DeForest Site, the final volume available for habitat enhancement should be determined, and if habitat management requirements are necessary to insure any infiltration requirements.

5.1.4 Basin Operations

Flood Storage

In general, wetland designs are anticipated to increase flood storage capacity under Alternatives 2 and 3. As final designs are completed, this will be verified, and any changes should be coordinated with LACDPW.

LACDPW has indicated that the DGSG connection proposed in Alternative 3 would require an automated control system since no staff are present in the area to manually control it (LACDPW 2002). This should be the case for all stormwater management systems; cost estimates should ultimately be revised to reflect automated controls. In addition, LACDPW recommends reviewing the cost estimate for the proposed inlet structure at DGSG; it may be low.

Pump Station Operations

LACDPW has indicated they anticipate no conflicts with Alternatives 2 or 3, based on conceptual designs. They also indicate they don't believe the MSPS encapsulation, as proposed under Alternative 3, and bypass siphons are necessary. Instead, they indicated that water flow through of the MSPS could occur by simply filling the pump station well and letting it overflow to the south side (CH2M HILL 2002c). This would save costs in infrastructure to encapsulate the MSPS and provide the siphon bypass. Preliminary cost estimates should be revised to reflect these proposed changes.

Under Alternative 3, additional water will be flowing to DGSG. The pump station operation for DGSG has not been reviewed to determine potential conflicts with this operation. This should be completed prior to final designs for Alternative 3.

5.1.5 Biological Resources

Mitigation Credits

LACDPW (2002) recommends applying for mitigation credits for site development involving restoration. The feasibility of this, along with potential conflicts with other objectives, should be evaluated.

Habitat Design

Species with questionable historical occurrence have been omitted from the final plant palettes provided in Appendix A, including western sycamore, coast live oak, and California black walnut. Additional revisions to the plant palette should be integrated as they are received. Target plant spacing, survivorship and growth goals, and cover targets should be developed in conjunction with final site design (CH2M HILL 2002c).

Site Management

Identifying responsible parties for implementing maintenance, as well as funding sources, should be conducted in the next phases of the Study implementation (LACDPW 2002).

Vector Management

A vector management plan should be completed as part of the final design of Alternatives 2 and 3 at the DeForest Site. This plan would identify responsibilities for control and monitoring of vector populations, a schedule for control and monitoring activities, and approved methodologies. The plan should identify a process for approval of new control methods, as they become available. Vector management will likely involve continuation of the current larviciding activities conducted by the Greater Los Angeles County Vector Control District for the Long Beach Environmental Health Bureau, the introduction of mosquito fish, and an active larval mosquito- and midge-monitoring program.

Exotic Species

Ongoing maintenance of the site should include a management program for exotic plant species. This may be especially important in the early stages of site restoration, but will be a continuing requirement throughout the life of the site. Exotic or feral animals may also compromise habitat quality, and a control program for these species should be developed (CH2M HILL 2002c).

Fire Control

It should be evaluated if there are any fuel load issues surrounding existing homes adjacent to DeForest Site, as well as access requirements associated with site roads; this may factor into final habitat design.

Water Quality Impacts

A more complete evaluation of potential negative effects of Los Angeles River water quality on biological resources should be conducted (LACDPW 2002). This should include potential effects from metals accumulation and if vegetation removal/disposal would be necessary.

5.1.6 Recreation/Public Use Resources

The following issues should be addressed in the Master Plan phase of project implementation:

- The possibility of a "ranger station", picnic area, and/or restrooms at the South Basin entrance. (CH2M HILL 2002d)
- Trail routing, with specific concern for minimizing wildlife impacts. (CH2M HILL 2002c)
- Fencing and access control, with provisions for dusk-to-dawn lockdown. (CH2M HILL 2002c; CH2M HILL 2002d)
- Possible additional composting toilets at dispersed locations. (CH2M HILL 2002d)
- The political acceptability of constructing a new parking lot.
- The relationship to potential public uses at Dominguez Gap.

- Architectural schematics.
  - The size/square footage of the Visitor Center.
  - The proportional amount of indoor classrooms vs. outdoor pavilions.
  - Incorporation of "green architecture" concepts, solar power, permeable pavements, hyperinsulated structures and related features.
  - Potential for minor kitchen facilities.
- Landscape and hardscape concept plans and preliminary details
  - Storm drain outfall re-design for aesthetic improvement and trash control.
  - Landscape screening along the mobile home park.
  - Interpretive, control and orientation signage design.
  - Potential fuel modification requirements if coastal sage scrub is growing next to homes.
- Programming and operations plan.
  - Interface with school districts.
  - Use of volunteers for minor maintenance.
  - Seasonal trail shutdowns to protect nesting areas.
  - Exclusion of dogs, motorcycles and mountain bikes.
  - Developing a "neighborhood watch" program.
  - Feral cat/dog controls.
- Cost estimates and project phasing.
  - Contingencies for interface with possible future land acquisitions, especially including the mobile home park north of Long Beach Boulevard.

5.1.7 Water Quality Improvement/Reuse

Initial models of water quality improvement were developed without the final results of Task 7, the Benchscale Study, due to schedule constraints. Now that the final results are available, they should be integrated into the water quality models to evaluate the treatment capacity of DeForest Site Alternative 2. Additional recommendations include the following:

- While adequate monitoring of the Los Angeles River has been conducted, only limited data is available both on quantity and quality of the storm drain water. This additional monitoring could assist in refining water quality improvement models, and may affect model parameters, such as temperature, as well.
- As wetland cell designs are finalized, the size of available wetland and precise treatment designs can be used to modify the treatment capacity model.
- Connections with the City's recycled water system were not explored. This should be evaluated to determine the nearest connection, and possible use location, for treated water leaving the system.
- The I-105 water apparently requires treatment for VOC's. This treatment has not been evaluated or included in conceptual designs. Where and who is responsible for this

treatment should be evaluated if the water becomes available for the project, and costs associated with this determined.

- Any effect of water rights issues, or conflicts with other water objectives, such as infiltration for the I-105 water, should be evaluated for potential constraints on reusing water once it has exited the treatment wetland.

5.1.8 Site Environmental

Two sites with potential for environmental impact on the DeForest Site were identified; these sites are approximately 0.34 mile and 0.38 mile southeast and east. Both are currently undergoing remediation for groundwater contamination. Because of the proximity of these sites to the DeForest Site, there is potential for the groundwater contamination to have migrated onto the DeForest Site. Based on the information provided in the EDR report, agency file review is recommended for the above-identified sites to further assess potential impacts to the DeForest Site.

5.1.9 Cost Estimates

Cost estimates are preliminary based on conceptual designs, and should only be used for planning-level purposes; they should be refined once final designs are developed. Additional cost recommendations include the following:

- Costs for additional feasibility analysis and recommendations identified here should be developed.
- Costs associated with the Caltrans I-105 water should be evaluated, including costs of procuring it, costs of treating it, costs of delivering it, and if Caltrans or WRD would contribute any to costs of developing the DeForest Site for receiving this water.

5.1.10 Regulatory Issues and Compliance

- There is some potential for attracting species listed as threatened or endangered under the state or federal Endangered Species Act; as such the City may wish to pursue a Safe Harbor Agreement with the USFWS and CDFG to protect future interests in the project site from management constraints should state or federally listed species colonize the site as a result of habitat improvements (see 50 C.F.R. SS 17.22[c] and 17.32[c]). This can be completed with a baseline survey and analysis, and application made to relevant agencies.
- Each alternative proposes some level of impact to existing wetland or riparian habitats on site. As such, it is expected that coordination and approval from the Army Corps of Engineers, California Regional Water Quality Control Board and California Department of Fish and Game will be required under the Clean Water Act Sections 404 and 401 and Fish and Game Code Section 1600, respectively.
- Ownership of the basin and operation of the site as a flood retention basin necessitates approval from Los Angeles County Department of Public Works.
- Use of LA River or Interstate 105 water at the site may require approval from the California State Regional Water Quality Control Board.

- Development of the site will require compliance with the California Environmental Quality Act.

5.1.11 Additional TAC and Public Input

Preferred DeForest Alternative

Generally, the members of the TAC favored the greatest habitat alternative at DeForest Site, which was Alternative 3 (LACDPW 2002; CH2M HILL 2002c). This alternative offered the most wetland habitat, which would benefit colonizing birds more than riparian habitat, which may never be present in enough extent for the typically territorial riparian birds. This maximized wetland habitat would be favored without conflicting with existing basin operations.

5.2 Sixth Street Site Alternatives

5.2.1 Physical Development

Site Grading

The proposed grading for Alternative 3 involves lowering the portion of the site north of the pump station down to tidal elevations. Optimal elevations for low salt marsh are approximately 4 to 7 feet above MLLW, with brackish or high salt marsh species occurring at elevations above this. The closest estimate of MLLW referenced to known site elevations would be –2.84 feet msl (NGVD–29); however, this is only an estimate. To accurately determine this, a tidal study at the site would be necessary (see discussion in *Task 3 Report*), and this should be conducted prior to developing final design for the site.

Site Soils and Geotechnical

Soil types at subsurface grades are unknown; they may not constrain site development. However, it is likely that substantial non-native fill is present on the site; this may include aggregate materials, urban debris, contaminated soils, or soils with chemical imbalances. For this reason, subsurface soil and geotechnical investigations are recommended before proceeding with final designs. This would be more of an issue for Alternative 3, but may constrain both Alternatives 2 and 3.

5.2.2 Utilities and Infrastructure

Storm Drain

Potential conflicts may exist with the underground pipeline that drains to the Sixth Street Pump Station from the north for both Alternatives 2 and 3. Final as-built plans should be obtained for this storm drain prior to final design for these alternatives, so conflicts can be minimized or accommodated.

Utility Conflicts

Numerous potential utilities were identified as present on the Sixth Street Site. Further review of this, beyond the preliminary review that was conducted, would identify more specifically potential conflicts that may have been missed in this initial Study.

Infrastructure Conflicts

Conceptual designs for Alternatives 2 and 3 would result in flowing and/or standing water beneath the Shoreline Drive overpass and Shoemaker Bridge pier footings. A geotechnical review and analysis of bridge pier structural stability under those conditions is advisable, since surrounding soils may become saturated. This analysis would determine the extent of likely saturation and the potential effects, if any, on bridge pier support.

5.2.3 Water Supply

Stormwater

Stormwater was identified as the source for Alternative 2 at Sixth Street Site. Current volume of stormwater flow is estimated, but is not known. This flow amount should be verified throughout the year to determine its contribution to supporting wetlands on the site, and if this proposal is feasible.

5.2.4 Basin Operations

Flood Control Operation

No alteration of the pump station or storm water removal is proposed under any of the Sixth Street Alternatives; however, the storm drains may require relocation under Alternative 3. To avoid flooding issues with creation of Alternative 3, further evaluation should be conducted of automated tide gate technology.

5.2.5 Biological Resources

Mitigation Credits

LACDPW (2002) recommends applying for mitigation credits for site development involving restoration. The feasibility of this, along with potential conflicts with other objectives, should be evaluated.

Habitat Design

Species with questionable historical occurrence have been omitted from the final plant palettes provided in Appendix A, including western sycamore, coast live oak, and California black walnut. Additional revisions to the plant palette should be integrated as they are received. Target plant spacing, survivorship and growth goals, and cover targets should be developed in conjunction with final site design (CH2M HILL 2002c).

Because salinity levels are presently unknown at the Los Angeles River at the Sixth Street Site, it is not known whether the site could support traditional salt marsh species or rather species adapted to more brackish salinity. Prior to developing final plant palettes and habitat and grading design for the site, salinity should be measured. This would require periodic sampling over a year to sample annual variation.

Site Management

Identifying responsible parties for implementing maintenance, as well as funding sources, should be conducted in the next phases of the Study implementation (LACDPW 2002).

Vector Management

A vector management plan should be completed as part of the final design of Alternatives 2 and 3 at the Sixth Street Site. This plan would identify responsibilities for control and monitoring of vector populations, a schedule for control and monitoring activities, and approved methodologies. The plan should identify a process for approval of new control methods, as they become available.

Exotic Species

Ongoing maintenance of the site should include a management program for exotic plant species. This may be especially important in the early stages of site restoration, but will be a continuing requirement throughout the life of the site. Exotic or feral animals may also compromise habitat quality, and a control program for these species should be developed (CH2M HILL 2002c).

Water Quality Impacts

A more complete evaluation of potential negative effects of Los Angeles River water quality on biological resources should be conducted (LACDPW 2002). This should include potential effects from metals accumulation and if vegetation removal/disposal would be necessary.

5.2.6 Recreation/Public Use Resources

The following issues should be addressed in the Master Plan phase of project implementation:

- A detailed Site Plan.
  - Trail routing, with specific concern for minimizing wildlife impacts. (CH2M HILL 2002c)
  - Fencing and access control, with provisions for dusk-to-dawn lockdown. (CH2M HILL 2002c; CH2M HILL 2002d)
  - Possible additional composting toilets at dispersed locations. (CH2M HILL 2002d)
  - The need for parking facilities, probably off-site.
- Landscape and hardscape concept plans and preliminary details.
  - Storm drain outfall re-design for aesthetic improvement and trash control.
  - Interpretive, control and orientation signage design.
- Programming and operations plan.
  - Interface with school districts.
  - Use of volunteers for minor maintenance.
  - Seasonal trail shutdowns to protect nesting areas.
  - Exclusion of dogs, motorcycles and mountain bikes.
  - Feral cat/dog controls.
- Cost estimates and project phasing.
  - Contingencies for interface with possible future land acquisitions, especially including Chavez Park expansion area and other properties north of the Shoemaker Bridge.

5.2.7 Site Environmental

One site with potential for environmental impact is the 1X Bulk Terminal Company, Inc. site; located approximately 0.24 mile north of the Sixth Street Site. The groundwater at this site is currently being monitored to characterize the extent of contamination. Because of the proximity to the Sixth Street Site, there is potential for the groundwater contamination to have migrated onto the Sixth Street Site. Based on the information provided in the EDR report, agency file review is recommended for the above identified sites to further assess potential impacts to the Sixth Street Site.

5.2.8 Cost Estimates

Cost estimates are preliminary based on conceptual designs, and should only be used for planning-level purposes; they should be refined once final designs are developed. Cost estimates should be developed for additional feasibility analysis, including the recommendations identified here.

5.2.9 Regulatory Issues and Compliance

- There is some potential for attracting species listed as threatened or endangered under the state or federal Endangered Species Act; as such the City may wish to pursue a Safe Harbor Agreement with the USFWS and CDFG to protect future interests in the project site from management constraints should state or federally listed species colonize the site as a result of habitat improvements (see 50 C.F.R. SS 17.22[c] and 17.32[c]). This can be completed with a baseline survey and analysis, and application made to relevant agencies.
- The site is under consideration for transfer back to the State Lands Commission as a former submerged land. As such, the planning and use of the site must meet the Commissions' goal of preservation of Public Trust values, which include fisheries, recreation and open space uses.
- Breaching of the Los Angeles River levee to create a tidal connection will require approval from the Army Corps of Engineers under Section 10 of the Rivers and Harbor Act and possibly Section 404 of the Clean Water Act, a California Department of Fish and Game Section 1600 Agreement and Los Angeles County Department of Public Works approval.
- Non-tidal alternatives for back dune and freshwater wetland creation will only require a Section 404 permit if existing onsite wetlands are to be impacted.
- Development of the site will require compliance with the California Environmental Quality Act.

5.2.10 Additional TAC and Public Input

TAC members expressed an interest in Alternative 3 for Sixth Street Site, since it created rare salt/brackish marsh habitat, particularly if it could be developed in conjunction with additional salt marsh habitat to the north.

Alternatively, one member of the public indicated they didn't consider the small acreage of salt marsh habitat that would be developed to be viable; that 10 acres would be a minimum viable salt marsh habitat. The Golden Shore wetland (6 acres) was considered a "boutique" wetland with limited value. Alternatively, back dune scrub habitat on the site could provide rare habitat for endemic species of butterflies as well as the federally endangered Pacific pocket mouse (*Perognathus longimembris pacificus*).

5.3 Next Steps

To realize the vision of habitat restoration and public use enhancement at the Deforest and 6th Street sites a series of additional steps must be undertaken. These include: a Master Plan process to refine alternatives, selecting the preferred alternative, completing the necessary regulatory/environmental compliance steps, completing the final design and bid documents, awarding a construction contract and implementing long-term operation and maintenance activities. Each of these steps is discussed below.

5.3.1 Master Plan

The next stage of the process should be a Master Plan phase. The Master Plan phase is the decision-making phase, which would entail selecting or merging the alternatives identified in the Feasibility Study into a single, more detailed Preferred Alternative. As a part of this process special studies should be conducted to address issues discussed under Sections 5.1 and 5.2. above. Continual Public and TAC involvement should be a critical part of the master planning process. The Preferred Alternative would be used to develop the Project Description for analysis under CEQA. Components of a Master Plan would normally include:

- A detailed site plan
- Architectural schematics
- Landscape and hardscape concept plans and preliminary details
- Programming and operations plan
- Cost estimates and project phasing
- Regulatory requirements and agency coordination
- Public involvement

5.3.2 Regulatory Compliance

Based on the selected alternative and the regulatory requirements identified for that alternative, approval applications and CEQA document preparation and analysis can be completed in coordination with regulatory agencies. If federal funding or approval is also required for the final alternative, NEPA documentation may also be required. Appropriate permit applications may include permit submittals USACE and CDFG. It is possible to overlap these activities with the Master Plan phase to some extent.

5.3.3 Final Design, Bid Document Preparation and Contract Award

During the regulatory compliance phase, detailed engineering design, habitat layout, planting plan and species selection can be undertaken. Detailed implementation drawings and project specifications can be completed and bid documents for distribution to

construction/landscape contractors completed. Completion of final design should be carefully coordinated with the regulatory compliance process to avoid costly re-designs or change orders as a result of changes to the project necessary to secure resource agency approval. During or prior to the final design period arrangements for contract growing of plant materials should be initiated. If funding is available initiation of exotic species removal can be initiated as well, as multiple years of eradication prove to result in the greatest suppression of weedy species.

An alternative approach to the typical design-bid-build process is the design-build process. In this approach, the City would contract with a firm to complete final design and construct the project based on the Master Plan and CEQA document. This approach is often much less expensive and much faster to implement. The selection of the firm(s) would be based on price after initial screening based on qualifications.

5.3.4 Long-Term Operation and Maintenance

The ultimate success of any restoration effort will depend upon the long-term commitment to operation and maintenance (O&M). Adequate funding for this important aspect of the project needs to be a priority. O&M needs to be considered in every phase of implementation. It would be best to downscale or downsize restoration and have funding to properly maintain the site than to implement a plan that will pose a burden on the City or other responsible parties. The Master Plan and final design documents should clearly identify the required O&M activities and these should be well coordinated with the potential responsible parties to ensure that the agency-will and the means are available to follow through. With the appropriate level of care and staffing both sites have the potential to greatly enhance the wildlife habitat available in Long Beach and the recreational opportunities available to its citizens.

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Appendix A
Revised DeForest and Sixth Street Sites Plant Palettes

Appendix A
DeForest and Sixth Street Sites Plant Palettes

Scientific Name[1,2]	Common Name	Indicator Status[3]
Deep Marsh Association		
Callitriche marginata	Water starwort	OBL
Lemna spp.	Duckweed	OBL
Potamogeton spp.	Pondweed	OBL
Rorippa nasturtium-aquatica	Water-cress	OBL
Shallow Marsh Association		
Carex praegracilis	Field sedge	FACW
Cyperus eragrostis	Tall flatsedge	OBL
Eleocharis macrostachya	Common spike-rush	OBL
Juncus spp. (*patens, acutus, mexicanus*)	Rush spp. (common, Leopold's, Mexican)	FACW to OBL
Juncus xiphioides	Iris-leaved rush	OBL
Scirpus californicus	California bulrush	OBL
S. acutus	Tule	OBL
S. americanus	Three-square bulrush	OBL
S. robustus	Big bulrush	OBL
S. maritimus	Prairie bulrush	OBL
Typha latifolia	Cattail	OBL
Anemopsis californica	Yerba mansa	OBL
Distichlis spicata	Saltgrass	FACW
Low Riparian Association		
Leymus triticoides	Alkali ryegrass	FAC
Artemisia douglasiana	Douglas mugwort	FACW
Bidens laevis	Bur-marigold	OBL
Carex praegracilis	Field sedge	FACW
Castilleja densiflora	Owl's clover	NL
Juncus spp. (*patens, acutus, mexicanus*)	Rush spp. (common, Leopold's, Mexican)	FACW
Lasthenia californica	California goldfields	FACU

Scientific Name[1,2]	Common Name	Indicator Status[3]
Layia platyglossa	Coastal tidytips	NL
Mentha arvensis	Field mint	FACW
Mimulus cardinalis	Scarlet monkeyflower	OBL
Muhlenbergia rigens	Deergrass	FACW
Rumex salicifolius	Willow-leaved dock	FACW
Salix hindsiana	Sandbar willow	OBL
S. gooddingii	Goodding's willow	OBL
S. laevigata	Red willow	FACW
S. lasiandra	Yellow tree willow	OBL
S. lasiolepis	Arroyo willow	FACW
Urtica dioica ssp. *holosericea*	Stinging nettle	FACW
High Riparian Woodland Association		
Baccharis salicifolia	Mulefat	FACW
B. emoryi	Emory's baccharis	FACW
Clematis ligusticifolia	Virgin's bower	FAC
Croton californicus	California croton	NL
Populus fremontii	Fremont cottonwood	FACW
Rubus ursinus	California blackberry	FAC
Salix gooddingii	Goodding's willow	OBL
Sambucus mexicana	Mexican elderberry	FAC
Vitis girdiana	Southern California wild grape	FACW
Native Scrub Association[4]		
Astragalus trichopodus var. *lonchus*	Coastal locoweed	NL
Artemisia californica	California sagebrush	NL
Atriplex leucophylla	Beach saltbush	FAC
A. lentiformis ssp. *lentiformis*	Brewer's saltbush	FAC
Baccharis pilularis	Coyote brush	NL
Camissonia cheiranthifolia var. *suffruticosa*	Beach evening-primrose	NL
Castilleja exserta	Purple owl's clover	NL
Croton californicus tenuis	Coastal California croton	NL
Encelia californica	Bush sunflower	NL
Ephedra californica	California ephedra (coastal ecotype)	NL
Ericameria ericoides	Mock heather	NL

Scientific Name[1,2]	Common Name	Indicator Status[3]
Eriogonum parviflorum	Coastal dune buckwheat	NL
Erysimum suffrutescens	Strand wallflower	NL
Eschscholzia californica	California poppy (coastal ecotype)	NL
Isocoma menziesii var. *vernonioides*	Coastal goldenbush	FAC
Isomeris arborea	Bladderpod	NL
Lotus scoparius	Deerweed	NL
Lupinus chamissonis	Coastal bush lupine	NL
Lycium californicum	California box thorn	NL
Opuntia littoralis var. *littoralis*	Coastal prickly-pear	NL
Rhus integrifolia	Lemonadeberry	NL
Salvia columbariae	Chia	NL
S. leucophylla	Purple sage	NL
Low Salt Marsh Association		
Batis maritima	Saltwort	OBL
Salicornia bigelovii	Annual pickleweed	OBL
S. virginica	Common pickleweed	OBL
Spartina foliosa	California cordgrass	OBL
Suaeda esteroa	Sea-blite	OBL
Triglochin concinna	Arrowgrass	OBL
High Salt Marsh Association		
Atriplex watsonii	Matscale	OBL
A. triangularis	Fat hen	NL
Cressa truxillensis	Alkali weed	FACW
Distichlis spicata	Saltgrass	FACW
Frankenia salina	Alkali heath	FACW
Lasthenia glabrata var. *coulteri*	Coulter's goldfields	FACW
Limonium californicum	Marsh rosemary	OBL
Salicornia subterminalis	Glasswort	OBL
Suaeda californica	California sea-blite	FACW
S. taxifolia	Woolly sea-blite	FACW

Scientific Name[1,2]	Common Name	Indicator Status[3]

Notes:

1- Sources: City of Costa Mesa 1998; Brinkman-Busi 1993, 1992; Faber et al. 1989; Mattoni et al. 1997; Brad Henderson (CDFG), pers. comm. 2002; http://www.calflora.org/; http://plants.usda.gov/; Madrona Marsh Preserve, Native Garden Plant List; Back-dune Restoration Plant List, 2000;

2- Plants indicated here represent plants with documented historical occurrence in designated habitat types in coastal Southern California, but may not be suitable or available for all restoration projects; verify final plant palettes for habitat restoration with restoration ecologist familiar with local conditions and plant availability.

3- Source: National List of Vascular Plant Species that Occur in Wetlands: 1996 National Summary, U.S. Fish and Wildlife Service, 1997; Indicator Status for plants in this table are for the California Region.

OBL = Obligate; greater than 99 percent chance of occurring in a wetland
FACW = Facultative Wetland; 66 to 99 percent chance of occurring in a wetland
FAC = Facultative; 33 to 66 percent chance of occurring in a wetland
FACU = Facultative Upland; 0 to 33 percent chance of occurring in a wetland
NL = Not Listed (generally indicates upland status; less than 1 percent chance of occurring in a wetland)

4- Coastal or near-coastal emphasis

CH2MHILL

3 Hutton Centre Drive

Suite 200

Santa Ana, CA 92707

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